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MODEL Airplane NEWS

NOVEMBER 2003

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MODEL Airplane NEWS

NOVEMBER 2003, VOLUME 132, NUMBER 11

ON THE COVER: Top Flite's Gold Edition Sea Fury is reviewed by San Kulesa on page 40 (photo by Deron Neblett). ON THIS PAGE: David West's Focke-Wulfe 190 on the flightline at the 12th Annual Warbirds over Delaware meet (photo by Gerry Yarrish).

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EDITORIAL

BY DEBRA CLEGHORN

Wings of war

What's your favorite warbird? Mustang? Curtiss P-40? B-25? The list of famous fighters is nearly endless, and when it comes to RC models, warbirds rule. This issue is packed with these awesome machines.

First out of the hangar is our cover story: the Top Flite Gold Edition Sea Fury. Built and reviewed by Stan Kulesa, this all-wood, .60-size model is destined to turn heads at any flying field. Next is our coverage of the annual "Warbirds over Delaware," where senior tech editor Gerry Yarrish got up close to a squadron of the best scale WW I and II models on the East Coast. He shares the highlights of this air-war weekend beginning on page 32. Last, but not least, is our featured construction article—the Martin PBM Mariner. Designed by Keith Sparks for two, .52 4-stroke engines, this flying boat features all-foam construction and a very scale outline. Anyone who has seen this model in action will testify that it's a majestic flyer that's equally at home on the water and in the air.

Warbird and sport-plane fans will appreciate Roy Vaillancourt's expert advice on how to paint with latex. Why switch to this kind of paint? Many reasons; you can get an exact color match at your local home-supply store; it's easy to use and non-toxic; and cleanup is a cinch with soap and water. On page 28, Roy follows up on his popular April 2001 article on latex paint techniques and offers tips for using latex with various types of coverings and for creating a weathered look. If you didn't see his previous article, you can check it out online by taking the Click Trip on modelairplanenews.com.

In his "RPM: Real Performance Measurement" column, engine guru Dave Gierke takes a closer look at the Evolution Power System from Horizon Hobby Inc. Designed for first-time pilots, this .46-size, 2-stroke system comes broken in and factory adjusted to guarantee your success at the field. But when Dave tested the basic engine, he found some surprising results that will interest even sport fliers and racers. Turn to page 90 to see why this system may be the perfect first engine—and more.

And don't miss our "Final Approach" column, in which we highlight the first nonstop RC transatlantic crossing. Well-known for his record-setting feats, Maynard Hill and his flight crew flew an 11-pound RC model from Newfoundland, Canada, to Ireland in August 2003. The 38-hour flight over the ocean set new records for distance and duration. Well done! We congratulate Maynard and his team for their achievement.

Safe landings!

MODEL Airplane NEWS

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WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ULTIMATE FAN

I'm a big fan of the Ultimate aerobatic biplane, and now that I've read the awesome review of Hangar 9's 46% TOC Ultimate 10-300 in the October issue, I've gotta get one! It sure sounds as if the adage "bigger flies better" is true. I've never built a model as large as the Ultimate, and before I take the plunge into giant, giant-scale, I have to ask a couple of questions. Why did the author use three battery packs? Can the MatchBoxes be eliminated? Keep the great reviews coming!

Steve Hansen [email]

Thanks for the comments, Steve; we're glad you liked the article! For us, it was definitely a highlight! Our reviewer, Sal Manganaro, has been building and flying giant-scale models for a number of years, and this experience led him to set up the Ultimate the way he did. As stated in the review, the Ultimate uses 15 servos, 14 of which are digital, and they place a huge demand on the batteries and the receiver. If the servos draw excessive current, the power to the receiver will drop off and cause it to work erratically. In

the Ultimate, one battery powers the servos, one is for the engine's ignition, and the third powers the receiver and the throttle servo. As you can see, each system has its own power source to ensure the utmost reliability.

As for the JR MatchBoxes, when multiple servos are ganged together to drive large control surfaces, they need to be precisely matched. If the servos don't move equally, they will fight each other. For example, let's say you use two servos to drive a single aileron. Servo "A" rotates 55 degrees, and servo "B" rotates 60 degrees. When servo "B" tries to reach the end of its travel (60 degrees), servo "A" is already at the end of its travel (55 degrees). In essence, the servos are fighting each other, and that demands more energy from the battery. No two servos have exactly the same neutrals and endpoints, but a JR MatchBox allows you to easily make servos (up to four) move exactly the same amount, and it prevents the servos from working against each other. Hope this answers your questions, and good luck with your Ultimate, Steve; you're going to love it! RB

POWERLINES

I'd like to congratulate Greg Gimlick on his new "Powerlines" column featured in the

power requirements; Greg's calculations [Editor's note: "Power 101" on p. 101] will help me to get started. I'd like to see more articles on conversion projects and a column on battery types and technology, too. Keep up the good work, Greg; there are many clean and quiet flyers out there, and we appreciate the info! Andrew Goyer [email]

We appreciate your feedback, Andrew. Big, fast, electric-powered planes with flight times that rival those of their glow-powered counterparts are everywhere, and we wanted Model Airplane News *to have a designated place for readers to find information on conversions and electric setups. Greg is already hard at work on some future columns, so stay tuned! DC*

FUEL FOAMING

I have an Irvine 53 engine in my Great Planes RV-4 with a Slimline muffler, and it runs on Wildcat 10-percent-nitro fuel with an APC 11x5 prop. It ran great on the bench, but when I installed it on the model, I couldn't get it to run rich enough. I added a Perry pump, and now it will run rich, but it only runs well at an idle or full throttle; at ¼ to ¾ throttle or midrange, it overheats and dies, whether its cowl is on or off. Other flyers in the club have the same engine and run the same fuel without a problem. What should I do?

Jim Overesch
Lenexa, KS

It sounds as if the fuel is foaming in the fuel tank, and the air bubbles lean the air/fuel mixture. The most common cause is an unbalanced propeller that generates unacceptable vibration levels throughout the airframe. After carefully balancing the prop, surround the tank with foam rubber (the same material as you would use to wrap a radio receiver); this will prevent residual vibrations from being transmitted into the tank.

Air bubbles can also be caused by a pinhole leak in the fuel delivery system; check all of the silicone fuel tubing (and the filter) between the tank and the carburetor inlet nipple. Disassemble the tank, and check the brass and silicone tubing inside for cracks and pinholes, too.

I don't think you'll need the Perry Pump if you solve the fuel-foaming problem. Remove the pump, run muffler pressure, reset the high-speed needle valve and the idle to factory specs, and try it again.

Finally, the APC 11x5 seems to be a bit too small (load) for a .53 engine; try an APC 11x6, 11x7, or 12x6 prop. Dave Gierke

WE NEED YOUR HELP!

In 2004, *Model Airplane News* will commemorate its 75th anniversary! We're excited to celebrate this milestone, and we want to remember and give credit to all of the amazing modelers who have written for *Model Airplane News* over the past seven and a half decades. We know that you, our readers, made this 75th celebration possible, whether you've been reading since 1929 or last month! We hope that you'll take a moment to jot down your favorite *Model Airplane News* article or column, or even a special memory associated with the magazine, and email it to us at man@airage.com. You can also send it to "75th Anniversary," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. We hope to use as many of your recollections as space will allow in our special 75th Anniversary Edition in January 2004, and throughout the year. Thank you!

AIR SCOOP

by the Model Airplane News *crew*

NEW PRODUCTS hit the market all the time, and here's the inside info on what's hot and where you can buy it. For every issue, we sift through product announcements and rumors, show reports and prototypes to let you in on the best and the latest. You'll see it here *first*!

LANIER RC

RAZOR 3-D ARF

Imagine this: you're at the flying field with your latest plane and are mesmerizing the crowd with perfect 4- and 8-point rolls, loops, harriers, waterfalls, blenders, flat spins ... you name it; you can fly it. Which plane can do all this and more? Meet the Razor 3-D—the latest ARF from the folks at Lanier RC. With all-wood construction, iron-on covering, a fiberglass cowl and wheel pants and swept aluminum landing gear, the Razor is built for style and strength. It also features oversize control surfaces, an airfoiled tail group and a split elevator bellcrank system for maximum flight performance. And we saved the best for last: this model comes in not one but four great color schemes and will only cost about $230. The hardest part will be deciding which one to choose! Specs: wingspan—54 in., wing area—560 sq. in.; length—42 in.; engine recommended—.40 to .50 2-stroke or .48 to .70 4-stroke; radio required—4-channel.

Lanier RC Inc. (770) 532-6401; lanierrc.com.

FMA DIRECT

FLIGHT SYSTEMS 5

The folks at FMA Direct are well known for being on the cutting edge of radio technology. Their Co-Pilot infrared-sensing autopilot revolutionized the way newcomers to the hobby learned to fly because it smoothed out an aircraft's flight and all but eliminated the chance of its crashing. Now FMA has added to its breakthrough line with a 5-channel receiver—the Flight Systems 5 (FS5). When used with the Co-Pilot, this 0.4-ounce receiver will put your model in a programmed holding pattern or a slow descent if it loses the signal or detects interference—and you don't need a computer radio to program it! The FS5 also has a "frequency-clear" feature that allows you to check your frequency before you turn on your transmitter. Its digital-signal recognition exploits the unique signature of PPM, so you can use it with PPM and standard FM transmitters with either positive or negative shift. The FS5 comes with new PC viewer software that you can use to check and record airborne telemetry, battery voltage, interference and more. The FS5 receiver, Co-Pilot and software together cost $179.95; if you already have the Co-Pilot, buy the $119.95 package.

FMA Direct (800) 343-2934; fmadirect.com.

HIROBO

Sky Trend Max

Worried that your thumbs aren't ready to keep up with those of the more experienced pilots at the field? This plane is made for you! Designed especially for beginner pilots by four-time F3A world champion Giichi Naruke, Hirobo's Sky Trend Max is a docile flyer that's ideal for mastering the basics. It features all-wood construction and high-quality covering, and it comes with all necessary hardware, including a fuel tank and landing gear. It even comes with six pieces of 7.5x4-inch covering so you'll be able to repair it in the event of a less-than-gentle landing! The Sky Trend Max would be ideal with an Enya SS40 powerplant. With a street price of $99, you can't go wrong!

Hirobo; distributed by MRC (732) 225-6144; modelrectifier.com.

MIDWEST PRODUCTS CO.

EASY CUTTER ULTIMATE

This tool makes it quick and easy to cut wood at an exact angle, again and again. It features a self-indexing, movable fence with seven frequently used angles; just select the angle and "click" the fence into position. The rest is easy! The Ultimate's high-carbon steel blades cut through wood like a hot knife through butter. Just like Midwest's other Easy Cutters, the Ultimate features a steel body, comfortable textured grips and a built-in safety latch. It's perfect for cutting stripwood that's up to ½ inch thick. And at only $24.99, it's a steal!

Midwest Products Co. (800) 348-3497; midwestproducts.com.

TOP FLITE

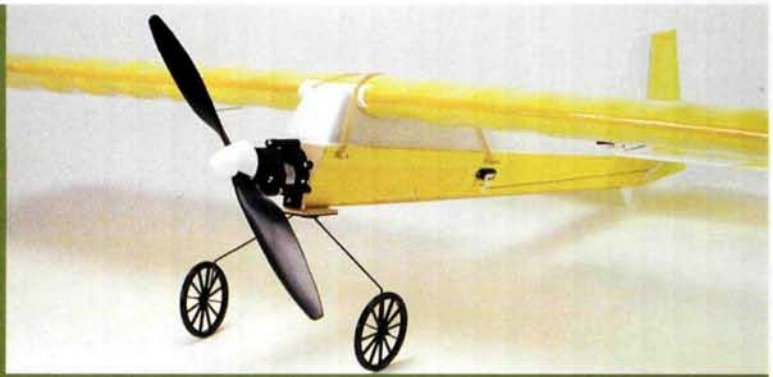
GOLD EDITION P-51D ARF

Start lining up for this beauty now! With an 84-inch, IMAA-legal wingspan and expert finish and scale details, this warbird won't stay on the shelves for long—especially given its price tag of less than $500. Like Top Flite's other Gold Edition ARFs, this plane will feature high-quality construction, MonoKote covering and a detailed cockpit. If its flight performance is even close to being as great as its looks, Top Flite has another winner in its hangar! Specs: wingspan—84.5 in; wing area—1,245 sq. in.; weight—17.5 to 19 lb.; wing loading—32 to 35 oz./sq. ft.; length—73.5 in.; engine required—2.1 to 2.8ci 2-stroke, or 2.5 to 4.3ci gas; radio—5- to 7-channel with 9 to 11 servos.

Top Flite; distributed by Great Planes Model Distributors (800) 682-8948; (217) 398-6300; top-flite.com.

WATTAGE

MAD MAX AND MINI BLUE MAX



Whether you're an aerobatics enthusiast or you prefer more leisurely, relaxing flying, these two new planes will fit the bill. If you like the wild performance of WattAge's Crazy Max, you'll love Mad Max. With bigger ailerons, a larger fuselage side area and more rudder and elevator response, the Mad Max delivers even more adrenaline-pumping, vertical performance. The Mad Max has a 34.75-inch wing and weighs just 13 ounces ready to fly.

Those who prefer low-speed flight will appreciate the Mini Blue Max–a new and improved version of the popular Mini Max. With carbon-fiber wing parts, fuselage and elevator stiffeners and optional ailerons, the Mini Blue Max offers great handling and maneuverability at low speeds. It weighs just 12 ounces and has a 40.5-inch wing.

Both planes come with a geared 370 motor, a propeller, micro hardware and a detailed assembly manual, and their low list prices ($70 for Mad Max; $5 less for Mini Blue Max!) make each a fantastic deal.

WattAge; distributed by Global Hobby Distributors (714) 963-0329; globalhobby.com.

HOBBYZONE

AEROBIRD CHALLENGER

Ready-to-fly fans have another reason to celebrate: the new Aerobird Challenger has fully proportional, 3-channel control for superior maneuverability. Ready for vertical maneuvers like loops, stall turns and tail slides? With the Challenger, they're a piece of cake. An advanced, multi-mode flight-control system allows pilots to choose between "Sport" and "Pro" modes; in Sport mode, the Challenger is smooth and manageable; in Pro mode, it's wildly aerobatic! And that's not all: the Challenger is also equipped with X-Port expandability, so you can add the optional HobbyZone Sonic Combat and Aerial Drop Module for extra flying fun. Like other Hobby Zone products, the Aerobird Challenger comes with everything you need to fly, including an installed motor, prop and rechargeable battery and an AC wall charger and transmitter. Slap on some decals, rubber-band the wing into place and you're ready for action!

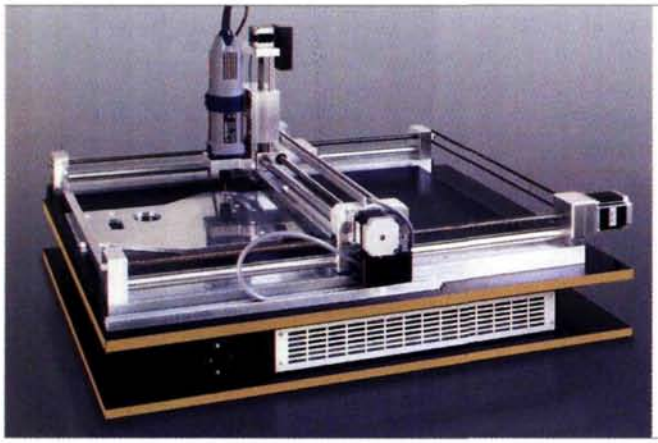
HobbyZone; distributed by Horizon Hobby Distributors (877) 504-0233; hobbyzonesports.com.

O.S. ENGINES

FS-70 ULTIMATE

O.S. engines are admired for their power and reliability, and this latest 4-stroke design is no exception. Designed especially for today's high-performance aerobats, the FS-70 Ultimate is an improvement on the already successful Surpass design; it delivers smoother, more consistent muscle, regardless of the plane's attitude. And amazingly, this predictable power comes from an engine that weighs 20 percent less than the popular Surpass 70SII! With a street price of around $320, that's a lotta bang for your buck. Specs: displacement—0.698ci; bore—1.091 in.; stroke—0.748 in.; practical rpm range—2,000 to 13,000; weight—16 oz. (bare), 18.6 oz. (with all parts included).

O.S. Engines; distributed by Great Planes Model Distributors (800) 682-8948; (217) 398-6300; osengines.com.



DEBECE

DTR 250S

Wouldn't it be great to be able to push a button and create parts you designed on AutoCAD or CorelDraw? Now you can! Check out debece's DTR 250S; it can mill and engrave metal, wood and plastic with CNC accuracy. The DTR 250S is accurate down to 0.001 inch, and it has a travel range of 23x39x3 inches, so you can even make larger parts. The company offers a full range of CNC machinery for hobby enthusiasts. Cost? The units start at $3,090 and go up to $4,540. Being able to make any engine part, scale fitting, or hardware? Priceless!

debece (615) 238-4884; debece.net.

CARL GOLDBERG PRODUCTS

30% ULTIMATE ARF

The Goldberg 30% Ultimate is smooth and stable at slow speeds, but crank up the throttle on your 4.2 gas engine, and this plane will tear up the sky! It features all-wood construction with a one-piece wing, aluminum landing gear, iron-on covering and a fiberglass cowl and wheel pants. Double-beveled control surfaces ensure exciting performance. Specs: wingspan—70.5 in.; wing area—1,692 sq. in.; length—78 in.; weight—20 to 22 lb.; price tag—$849.99.

Carl Goldberg Products Ltd. (678) 450-0085; carlgoldbergproducts.com.

TIPS & TRICKS

Illustrations by Mark Schroeder

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.

SERVO-SAVER

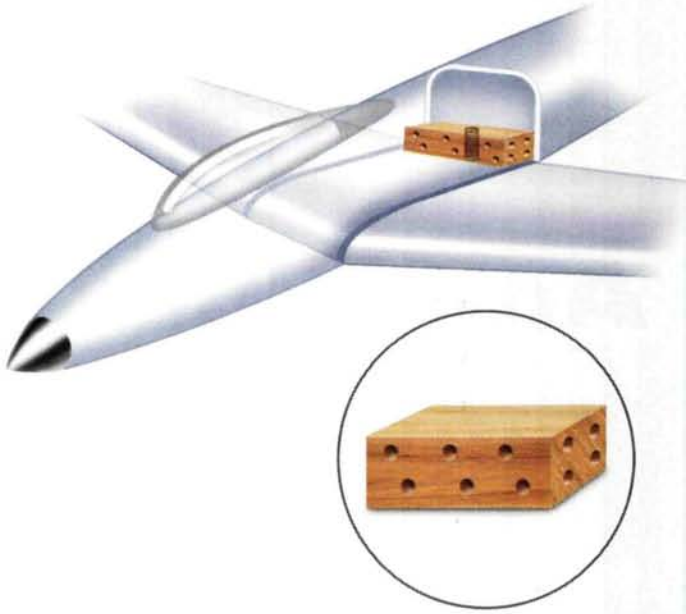
Murphy's law dictates that if your servo post is going to strip out, it will happen when you're at a meet and 100 miles away from the closest hobby shop. When this happened to Luis, he came up with a simple solution that saved his servo. First, he cut a slot in the servo post; then he added the servo arm and inserted a screw that was slightly larger than the original. This expanded the post enough for it to fit the center of the servo arm snugly. He says, "It works like a charm: it holds tension and torsion well, and I haven't had to change the stripped post after all."

Luis Urbina, Gadsden, AL

SUPER-STRONG WING MOUNT

It's important for the hardwood block that holds your wing-mounting bolts to be secure and stable. Instead of simply gluing the block to the fuselage with epoxy and perhaps some triangle stock for support, try Frank's method; it improves this critical glue joint. With an 1/8-inch bit, drill half-a-dozen, 1/8-inch-deep holes in the side of the block that will be glued to the fuselage. When you attach the block to the fuselage, be sure to fill these holes with epoxy. When the epoxy cures, you'll have a series of epoxy pegs that will greatly add to the strength of the joint.

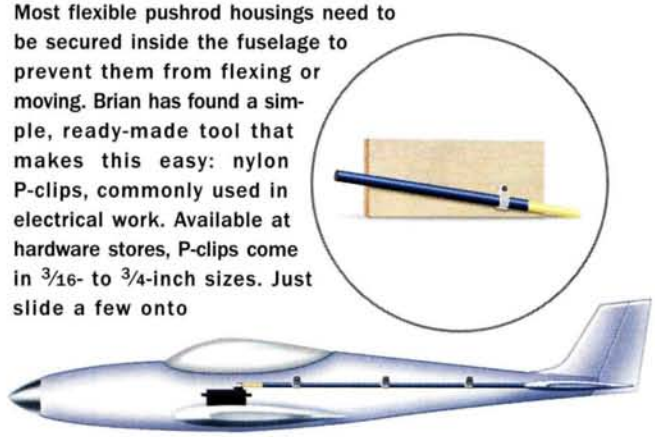
Frank Jaerschky, Trenton, Ontario, Canada



P-CLIPS AND PUSHRODS

Most flexible pushrod housings need to be secured inside the fuselage to prevent them from flexing or moving. Brian has found a simple, ready-made tool that makes this easy: nylon P-clips, commonly used in electrical work. Available at hardware stores, P-clips come in 3/16- to 3/4-inch sizes. Just slide a few onto the outer pushrod housing, align them with a balsa or plywood section, and secure them in place with a Rocket City Pin Clamp (inverted, so the small section fits into the hole in the clip) and a standard pin. Slide the housing back and forth until your control system works the way you'd like, and attach the clip, clamp and outer housing to the model with silicone rubber. Brian writes, "This system is secure, neat and excellent for setting up systems that require a radius or two."

Brian Winch, Lurnea, NSW, Australia



KEEP IT TOGETHER

It can be a challenge to keep servo leads and extensions together in a model plane that flies in all directions. John discovered a simple solution: apply a drop of flexible CA to the back of the servo plug (the side without the pins) and then plug it into the extension. If you need to take the plugs apart, just slip your hobby knife between them and cut through the CA. You'll easily be able to scrape the dried CA off with the hobby knife. Because flexible CA is rubberized, it won't crack under vibration, so your connections will be secure.

John Goscinski, Orlando, FL

PILOT PROJECTS

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable, but please do not send digital printouts. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

CESSNA 310

Lou Oskowski, Edmonds, WA

Lou commemorated his Cessna 310's 16th birthday in the mountains of Washington state. His ¼-scale plane weighs in at 34 pounds and has a 120-inch wingspan. A pair of Saito 1.20 4-stroke engines powers the model. This big bird is equipped with brakes, flaps and wooden 3-blade propellers. Lou writes, "She loves to roll and is still going strong." We say happy birthday—and many more.

FLEET MODEL 1

Dave Seale, Dedham, MA

Can you believe this impressive model is Dave's first attempt at scratch-building? Dave used Bill King plans that were originally featured in the December 1964 issue of *Model Airplane News* and are still available at RCStore.com. The 9-pound plane is powered by a Saito .72 4-stroke engine and is covered in 21st Century's Coverite. Dave uses Futaba controls with five S3004 servos. Don't we all wish our first scratch-built model looked this great?

CORSAIR

Lenny Halzel, Providence, RI

Thanks to Lenny's detailing, this warbird looks as though it has already seen some battle time. Lenny credits Dave Platt's "Painting and Detailing" video with helping him to learn how to create the panel lines, rivets and weathering. The 86-inch-span model weighs 30 pounds and is powered by a 3W75 gas engine. Lenny applied ¾-ounce fiberglass cloth over the balsa with West System epoxy. Robart main-gear and tailwheel retracts provide the finishing scale touches.

PT-23

Wayne Reynolds, Bath, NY

Wayne writes that he "kit-bashed" his Dynaflite PT-19 into a PT-23, and the resulting model "flies like she was born for Sundays." A Saito 1.20 4-stroke provides the power, and a scratch-built, dummy 7-cylinder radial adds to the scale appearance. The model is also equipped with PT-19 struts from Robart. Wayne credits Gerry Yarrish's "Thinking Big" columns for teaching him about giant-scale construction and flying techniques.

GRUMMAN GOOSE

Henry Simon, Bobcaygeon, Ontario, Canada

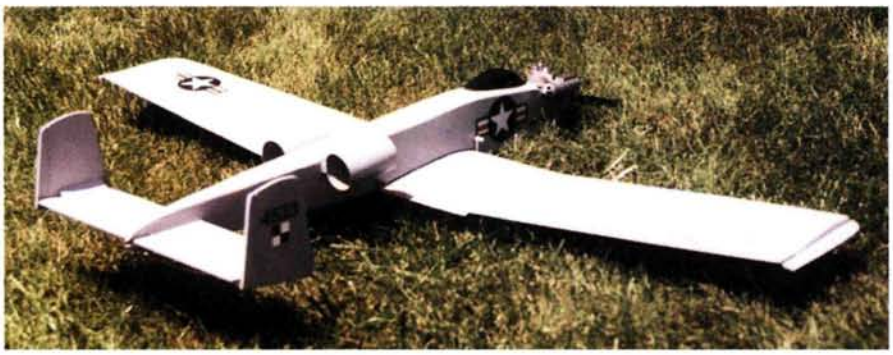
Just like the bird it's named after, this amphibian is at home on land, water and in the sky. Henry drew plans for this plane using 3-view drawings and photos from Bob Banka's Scale Aircraft Documentation. The 65-inch-span plane weighs 7.2 pounds and uses balsa-and-ply construction with a fiberglass and epoxy-resin covering. Power is provided by an electric motor from Model Motors on two, 8-cell, 1700mAh battery packs wired in parallel. We hope this one will fly south for the winter so we can get a look-see!

KERR KNIGHT FLYERS
Ron Kucera, Elk Grove, CA

For more than a decade, Ron has organized the Kerr Knight Fliers, an 8th-grade after-school program at Joseph Kerr Middle School. This year, the group built four Dymond Modelsports Pinnacles. Each 59-inch-span plane uses a 480 motor and a 6x3 prop with an 1100mAh Ni-Cd battery pack. Hitec Laser 4-channel radios and 555 receivers provide control. Ron writes that some of the students' first flights exceeded 30 minutes with the help of "some good thermals and throttle management." Awesome program, Ron!

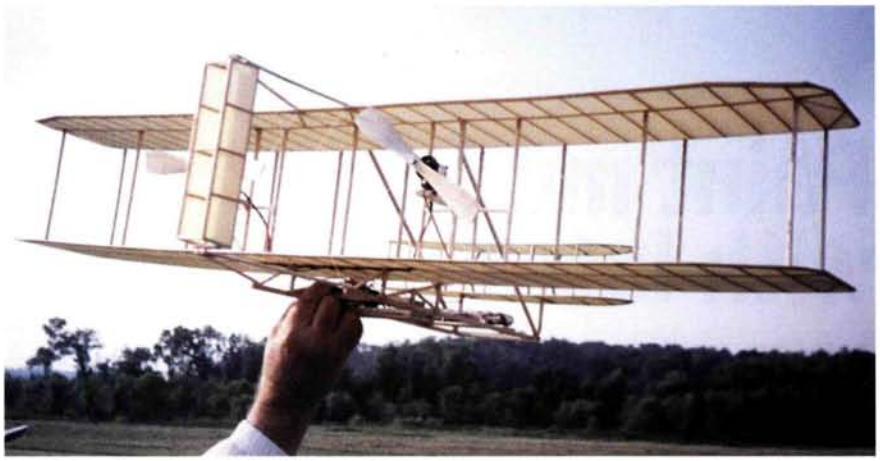
RED-TAILED HAWK
Mahlon Hirsch, Fairview, PA

Mahlon's Red-Tailed Hawk was inspired by Bob Hoey's article in the June 2002 issue of *Model Airplane News*. The nearly 6-foot-span plane weighs 2¾ pounds. To get it to soaring altitude, Mahlon usually piggybacks it on a Sig Senior Kadet. He writes that it thermals nicely and is so realistic that real hawks have attacked it! We love the artistic creativity of this predator; thanks for sending the photo, Mahlon.



A-10 WARTHOG
George Ewing, Peabody, MA
George built this "squint scale" A-10 from his own plans and writes that its fully symmetrical airfoil enables the 36-inch-span model to fly smoothly. The plane is powered by an O.S. .15 FP that spins a Master Airscrew 8x4 prop. George used Futaba sub-microservos throughout, including one for each aileron. Nice work, George.

WRIGHT FLYER
Paul Gaertner Jr., Athens, GA
Paul's kit-built Dare Engineering Wright Flyer is equipped with hand-carved propellers, Sky Hooks & Rigging electronics and Hitec servos. Paul writes that the plane flies smoothly and that "all landings have taken place over the proverbial tall grass." We certainly hope the trees in the background are for scenery; this delicate flyer should be saved for calm days and open fields. It's a real gem, Paul.



click trip
MODELAIRPLANENEWS.COM
FOR MORE INFORMATION ON LATEX PAINT

Paint models with latex

by Roy Vaillancourt

More information on this great technique

Not only is latex paint non-toxic, easy to clean up and environmentally friendly, but a paint-supply store can also exactly match it to a color chip or other scale documentation. I first detailed how to paint with latex in the April 2001 issue of *Model Airplane News*, and since then, many modelers have written to ask me questions or to report their success. It seems that many of you still have questions about this process, and even those folks who have had pleasing results have follow-up questions. In this article, I answer some common questions and share a few tricks and tips that I learned since I wrote the last one. *Editor's note: to see Roy's original how-to article, take the Click Trip at modelairplanenews.com.*

Q CAN YOU USE LATEX PAINT ON A NITRATE OR BUTYRATE DOPE WITHOUT A PRIMER?

A Yes, but the key is to make sure that the dope is fully cured. Most dopes release gas for a fairly long time—sometimes for three to five weeks, depending on the temperature and humidity. To test it, sniff the surface; if you can still smell the dope, it isn't fully cured. If you paint over the dope before it is cured, you trap the gas, and it will eventually dissolve the latex or lift it. (This also happens if you put epoxy, primer, or other paint over dope before it's fully cured.)

In most cases, you don't need to use a primer over the dope. If you want to use a primer, solvent- and water-based ones will work. If you use a solvent-based primer, confirm that it is fully cured before you apply the latex. In any case, give the latex something to adhere to: sand the surface with 280- to 300-grit sandpaper.

Q WHAT ABOUT UNPRIMED FIBERGLASS OR PLASTIC PARTS?

A You can put latex directly on raw fiberglass, but first fill all of those little dents, pinholes and such. The best method is to sand the fiberglass first and then shoot two coats of primer over it. Next, sand the primer almost off to leave a faint gray area to show you where your plane needs a little more work. Fix these areas, and apply just enough primer to cover the repair. Sand the area again lightly. Try to maintain a light shade of gray. When I sand off all the primer before I apply the latex to the raw fiberglass, I get a great finish without the added weight of the primer. You can also apply latex directly to unprimed plastic parts and be sure of great results. Whether you paint fiberglass or plastic, the key is to make sure that the surface has enough "bite" for the latex to bond; 280- to 320-grit sandpaper works best. Don't make the parts too smooth, or the paint won't stick well to the surface.

SPRAYING TIPS

When I use a touch-up gun or an airbrush, I start with approximately 20psi of air pressure from the regulator. This varies plus/minus 5 pounds, according to the brand of paint used. It's funny, but not only does the paint's brand and the amount of thinner you use make a difference, but so does its color! Different colors contain different amounts of pigment particles. You can use any type of paint; just be ready to play the air pressure-versus-thinner game.

In a small jar, mix a little 20-percent thinner with some paint. (I mix up an amount that would fit in a baby-food jar.) Try to spray it through the gun onto a piece of glass. If paint doesn't shoot out of the gun, increase the air pressure a bit. If it still doesn't flow, return the air pressure to the previous setting, add more thinner and try again. If the gun spits the paint, add more thinner; if it comes out really wet and runny, you added too much thinner and must add more paint. If it looks dry, increase the flow of paint or add thinner. The object of this game is to use the sample in the small jar to determine the proper ratio of paint to thinner and the correct pressure setting for that color. Colors differ even if they're from the same manufacturer. The appropriate air pressure will rarely be below 15psi, and you should avoid setting the air pressure above 30psi.

Latex seems thick and heavy when you compare it with other paints, yet you'll find that it's usually lighter when it's dry. It develops very little overspray, and it's easy to clean off your tools and equipment with regular soap and water.

I use an assortment of inexpensive airbrushes for small areas and fine details.

In my L-5 and the Focke-Wulf, even the pilots are painted with latex.

Q WHAT ABOUT UNPRIMED FABRIC AND PLASTIC FILM?

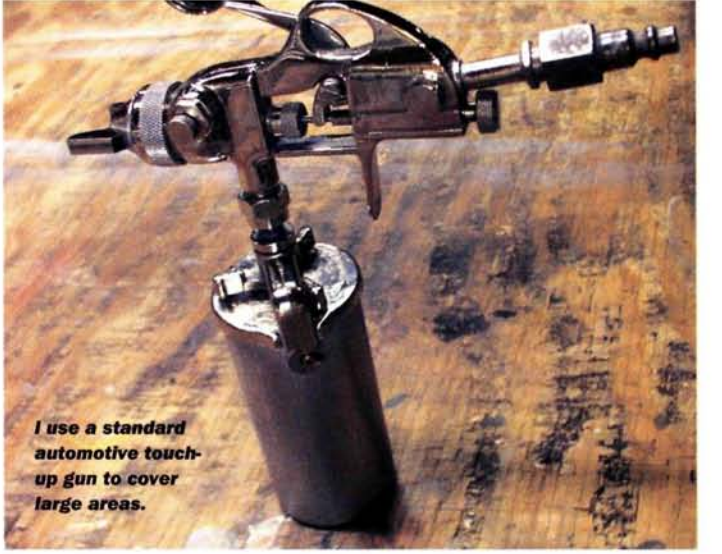
A I have painted fabric-covered aircraft and those with only fabric-covered control surfaces without priming the fabric. I applied the latex to "raw" Super Coverite. The latex took to the Coverite as if it had been made especially for it—great! When the fabric sags or becomes "dented," you can apply heat to reshrink it, and the paint just goes along for the trip. This technique can also be used on any iron-on fabric covering. I also discovered that latex paints don't crack because of vibration or when parts shrink or expand. Remember, latex is rubber!

You can also paint over plastic film, but you need to roughen it first. Remember: latex needs to bond mechanically with the surface. Steel wool will work well to roughen plastic film. The finer-steel wool "grits" are graded in an "aught" scale: 0, 00, 000, 0000. The more 0s, the finer the steel wool. For most plastic films, "triple aught" (000) or "four aught" (0000) works best. You should always test a piece of scrap material first; if the latex paint you apply peels off, you need to use a coarser steel wool.

Q WHICH KIND OF PRIMER IS BEST?

A When I use a primer, I usually choose automotive lacquer (solvent-based); I only recently tried others. Some water-based primers work very well and "sand" just like the lacquer, but I've found that they take longer to dry than solvent-based primers; both work well to fill those little nicks and dings. I prefer to use a light gray or white primer because the colors show the surface imperfections a bit better than other colors after filling and resanding, and they provide a better base for any subsequent top color.

On the left: two types of Benjamin Moore paints that I use. The AquaVelvet® produces an eggshell finish and the MoorGlo® produces a semigloss finish. The cloudy jar just contains thinner (water), and a bottle of Floetrol® is to the right.



I use a standard automotive touch-up gun to cover large areas.

Q CAN I USE A HIGH-VOLUME, LOW-PRESSURE (HVLP) SPRAY GUN?

A You should be able to use any HVLP guns on the market today. You'll need to play with the air pressure and the quantity of thinner you use. Don't be afraid to experiment; latex paint varies with the manufacturer. You will also find that using a different color can require you to change your settings and technique. Just go easy, and change only one setting at a time.

Q MUST I CLEARCOAT LATEX TO FUELPROOF IT?

A This depends on the kind of fuel you use. If you use a gas engine, you don't need to clearcoat the latex. It withstands exposure to gasoline very well after it has cured. If you use a glow engine, however, you will need to clearcoat; latex turns into a gooey mess when glow fuel gets on it.

Q WHAT'S THE BEST CLEARCOAT METHOD?

A Clear epoxy and polyurethane work well, but again, you must wait until the latex has fully cured. Also, be careful not to flood the surface with the clearcoat. If you plan to use water-slide or vinyl, pressure-sensitive decals, let the latex fully cure before you apply the decals. When everything is fully cured (after about a month or so), you can add a top coat. The key is to apply light coats; don't get the latex too wet. You'll need only a little more than a misting of clear.

Keep in mind that some epoxy and polyurethane paints use a toluene-based thinner that attacks latex. Check the can! Water-based polyurethane and epoxy work fine.

I have top-coated latex many times and prefer to use K&B's clear Hobby Poxy. On my military planes, I mix the clear

with "satin" hardener, and I sometimes add talcum powder to the mix. Some modelers don't like to clearcoat because it can "yellow" over time, but my old WW II birds get better-looking with this "aging" process. On sport models, I use a glossy clearcoat and a few coats of auto wax from time to time to prevent UV rays from turning the clearcoat yellow.

I have never used a polyurethane color coat. I don't like to work with these paints because they are too heavy and messy. They are also very difficult to match if you need to repair your plane. If you want to try clear polyurethane, I suggest that you test a few samples first. Spray a piece of glass and let the polyurethane cure for about a week. Then apply raw fuel, and note the results.

Q HOW DO YOU MASK COLORS AND PREVENT BLEED-OVER?

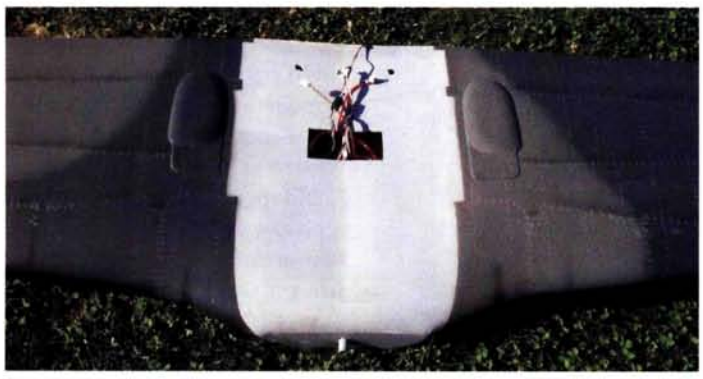
A Go to your local auto-body-supply shop and buy masking tape. Use the good 3M stuff; the blue, low-tack type works best. Don't use cheap stationary-store masking tape. After you've covered all of the areas that you don't want to paint, spray the paint lightly along the taped edge, and gently dry it with a heat gun. Repeat this twice (three times total) before doing the entire area.

After you've applied the last coat, partially force-dry the paint near the tape, and then remove the tape and allow the paint to cure fully.

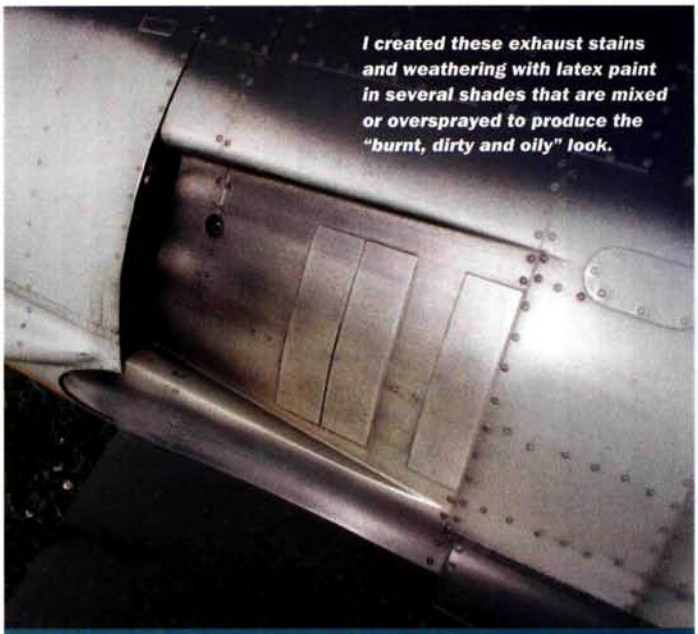
Q WHICH THINNERS AND/OR ADDITIVES WORK BEST?

A Naturally, most people expect me to say "water." Some guys suggest regular tap water; others use distilled water. Both work well, but I prefer to thin latex with an alcohol/water mix or—better yet!—windshield-washer fluid. Yep; windshield-washer fluid. You can use any brand, including the cheap blue stuff. Don't worry about the blue tint; it doesn't change the paint's color. The interesting thing about them is their soap content; they all have soap, and it slows drying to allow the paint to "flow" more and produce a better finish on almost any part. Once it has fully cured, latex thinned with windshield-washer fluid can be weathered just like epoxy and lacquer—really neat!

The only material I add to latex is Floetrol; it allows the latex to flow out without running. It also lubricates spray guns, and slightly reduces latex's sheen. (Latex dealers will tell you it doesn't, but it does.) You can get Floetrol from stores that supply professional house painters who use it when they roll and spray paint. Add about 2 ounces of Floetrol to a quart of paint before you do anything else. This is the only time you'll add this stuff, so you won't need to buy much.



This is the wing of my FW-190. I primed the entire plane and attached the wing to the fuselage. Then I painted the entire plane with latex, but I left the center section of the wing unpainted to minimize weight and allow the plane to be assembled without the wings sticking to the fuselage.



I created these exhaust stains and weathering with latex paint in several shades that are mixed or oversprayed to produce the "burnt, dirty and oily" look.

ADVANCED TECHNIQUES: WEATHERING AND RIVETS

Now that you have mastered latex painting techniques and finished your latest warbird, assemble it and put it on a table (before you clearcoat). Look at your handiwork with an objective eye, and you'll probably notice that it looks too clean! It needs a little dirt, oil stains, engine and gun exhaust and dirt smears on all the panel lines. You know: all the signs that this was a "used" combat machine. Let's add some weathering!

Let the latex cure for a few weeks so that any water you apply won't affect the finish. First, try just a little dark gray chalk from the art supply store (the art guys call this stuff "pastels"). It looks and feels a bit like a crayon—kind of waxy and chalky at the same time. Apply the color with your finger to each vertical and horizontal panel line. Then use a soft rag to draw the chalk toward the rear; only work from front to back. You'll see that as you do this, the chalk smears and thins out simultaneously. Keep working it this way until it looks like an old oil smear on the surface. It should be very faint at the rear and slightly more pronounced at the panel line. Make sure that the color is only to the the rear of the panel line; the area to the front should be relatively clean.

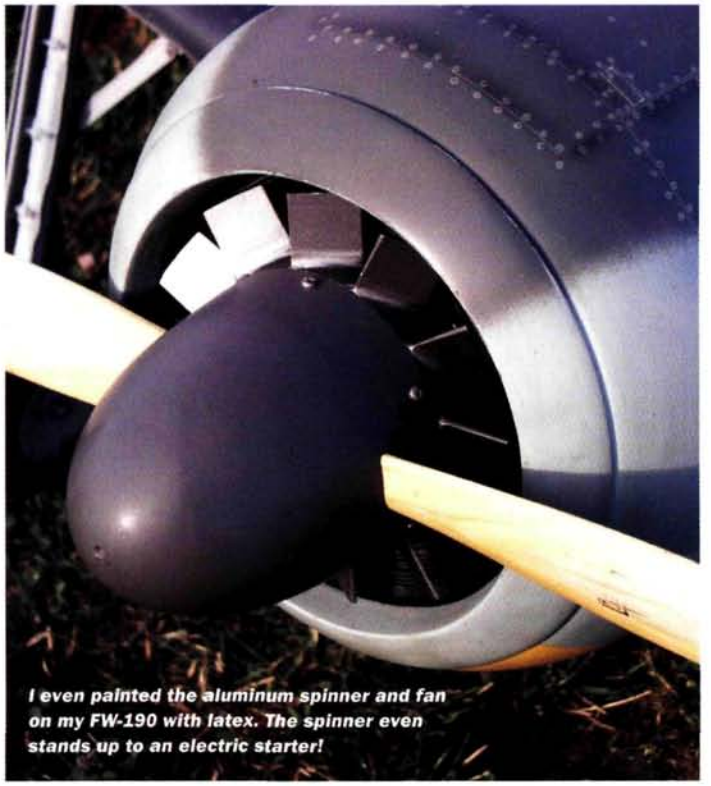
Give the chalk a try. Use the model's bottom to practice. It won't hurt the paint and, if you don't like it, you can wash it off. Eye shadow also works. Again, all of this will wash off, if you don't like it.

Did you add rivets, too? If so, try this little trick (after the chalk treatment for the panel lines): sprinkle baby powder on the wing and fuselage and spread it all over the plane. Again, lightly wipe the surface with a soft cloth in the appropriate direction: front to back on the wing and top to bottom on the fuselage. The powder will "fill" all rivets and panel lines just enough to make them look as if they have dirt and grime in them. Then with a soft brush, brush in the same direction as you did with the cloth. (Don't worry about getting powder in the cockpit; it should look weathered, too, and the light dusting of powder will tone down the interior just right). Now blow off the entire plane and cockpit with low-pressure air, and wipe the plane down a few more times with the cloth. Stand back and look at your new "old" airplane. Once again, if you don't like it, it will wash off.

When you are satisfied with the appearance of your plane, clearcoat everything to keep it in place. Naturally, your bird should be clearcoated in satin or flat clear—not glossy. You'll notice the weathering effect improves each time you handle your plane. All of this "dirty work" really makes the model look like a shrunken miniature. Just remember: go very easy when weathering; less is best.

Q WHICH TEMPERATURE AND HUMIDITY CONDITIONS ARE IDEAL FOR PAINTING?

A Weather doesn't matter when you paint with latex. I usually paint in my basement during midwinter, and the temperature in my shop is typically around 55 degrees. (I like it cool!) You can spray latex on a rainy, cold, damp day, and you'll get the same or better results as you would on a sunny day. In fact, it's easier to work with latex on cold, damp days. I use a heat gun to accelerate the drying time between coats. I spray the first coat on just enough to see coverage; then I dry it with the heat gun. I let the second coat go on just a bit wetter, and again, dry it with the heat gun. After I've applied a third coat, I leave the model to dry overnight. Just to make sure that the latex has cured, I go over the painted area with the heat gun again, and then I'm ready to mask for the next color.



I even painted the aluminum spinner and fan on my FW-190 with latex. The spinner even stands up to an electric starter!

I used a small airbrush to create all of the markings on the FW-190.

TIPS AND TRICKS

When it comes to curing latex (or any painting process), time is the most important ingredient. Sunlight seems to hasten the process, so after I've finished a plane, I set it out on the patio table every day that weather permits. If you put a plane together on a hot day before the latex has hardened, the wing and fuselage may stick together. To avoid this, I put baby powder on the wing saddle the first few times I assemble a plane.

Another really neat thing about latex is that if you don't like the paint job or you have runs, splatters, or dog hairs in it, you can just wash it off with a damp rag, dry the surface with a heat gun and paint it again. If a dog hair or bug gets in a part that's still nice and wet, just pick out the offending object with some tweezers and leave the paint alone (don't force-dry it). By the next morning, the latex will have flowed to cover the spot you touched.

I hope I have answered most of the questions that lingered after my previous article on this subject. You will find that the first few times you try to use latex, a bit of trial and error is required. Practice on a scrap piece of glass. And remember: if you don't like the first shot, just wash it off and have another go! Good luck. Don't be afraid to experiment with materials and procedures; it just takes a little practice and experimentation to get great results. ✈

12th annual warbirds over delaware

a perfect weekend for dogfights!

by Gerry Yarrish

Brad and Colin Hensley came all the way from Santa Barbara, CA, to fly their great-looking Yellow Aircraft Zero at the Warbirds over Delaware event! Powered by a G-38, the Zero flew extremely well.

WINGS OF WAR

It had been several years since I last attended the IMAA Warbirds over Delaware (WOD) meet, so I was very pleased to cover the 2003 event for this issue. The trip to Newark, DE, takes me about 4 hours, so I loaded up my trailer the night before and headed out early Friday morning. When I arrived, I quickly set up the tent and unloaded my models and then just sat there for a minute or two to let it all sink in. In front of me was the huge, beautifully groomed runway, and stretching the full length of the flightline were rows and rows of similar tents that were all filled with big, beautiful warbirds.

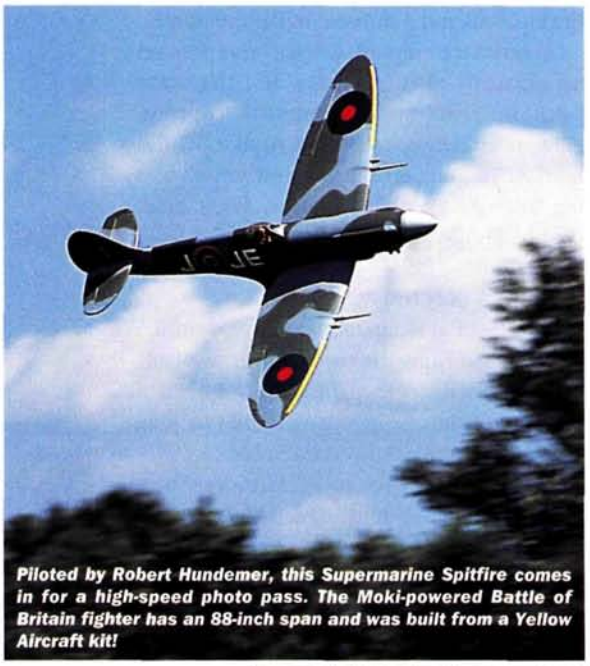
The WOD is much more than just a giant-scale model event. It's a place where friends meet year after year to show off their latest projects; it's a place where history is paid homage, and it's a grand opportunity to see some of the best warbird models flown on the East Coast. By the time I had unpacked my camera gear, I had made up my mind that I wouldn't wait as long to come back again for the weekend event.

Trent Wilhelm's impressive Douglas AD Skyraider comes in with a full rack of rockets slung under its wing!

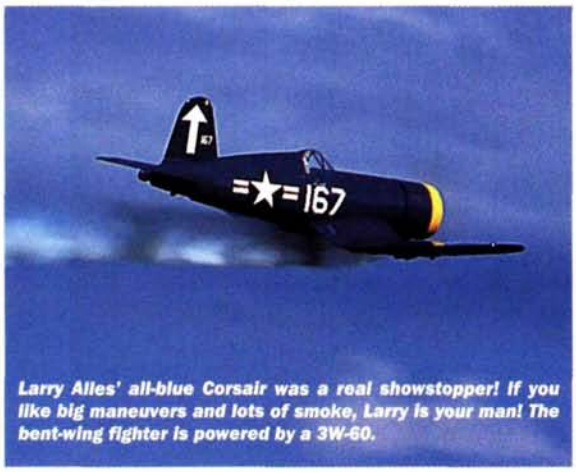
Trent Wilhelm flew this beautiful North American B-25 medium bomber. Powered by twin U.S. Engines 41s, the 110-inch bomber made some scary low passes!

This is a great example of the type of model that finds its way to the Delaware Warbirds meet! This impressive PBM-5A patrol and rescue plane is the work of Hank Likes of Mechanicsburg, PA. The impressive amphibian has a 10-foot span and is powered by twin O.S. .90 4-stroke engines. The 27-pound model is scratch-built and outfitted with Hanks' own Likes Line retracts.

Andy Kane flew this beautiful Dauntless torpedo/ bomber with a vengeance! Powered by a Zenoah G-62, the 102-inch Navy plane has functional dive brakes and Robart retracts.



Piloted by Robert Hundemer, this Supermarine Spitfire comes in for a high-speed photo pass. The Moki-powered Battle of Britain fighter has an 88-inch span and was built from a Yellow Aircraft kit!



Larry Alles' all-blue Corsair was a real showstopper! If you like big maneuvers and lots of smoke, Larry is your man! The bent-wing fighter is powered by a 3W-60.

Spectators numbered in the thousands!

Trent Wilhelm surprised everyone when he pulled out his manned version of the WW II V-1 Buzz-Bomb! Powered by a small glow engine, the Luftwaffe terror-weapon flew very well.

A PERFECT WEEKEND

Hosted by the Delaware RC club, Warbirds over Delaware is always held on the weekend after the 4th of July, and this year's event marked the 12th anniversary of the Lums Pond State Park get-together. The weather couldn't have been better. I was a bit waterlogged from all the rain in my neck of the woods, so getting a little sunburned over the weekend was a small price to pay. Blue skies, a mild breeze and a ton of killer warbirds is a hard combination to beat!

The flying site is one of the best I have ever flown at; it's in a state park, and the site is impeccably maintained. Ample parking space and the spacious pit areas make it an ideal venue. Contest directors Pete and Dave Malchione reported that this year's event had the best attendance ever, and the pilot count was over 160 with close to 300 models—impressive numbers indeed! A look at the registration forms showed pilots had come from California, Florida, Connecticut, New York, Pennsylvania, Delaware, New Jersey—and even the UK—to chew up the skies over Delaware!

"Fast" Eddie Leauter was the announcer, and his good-humored litany kept everyone well informed. Whether it was a WW I biplane, a German dive-bomber, or a South Pacific fighter, Eddie was very fast in correctly identifying the model and its pilot!

One of the things that makes the WOD special is the club's close relationship with local charities. This year, a portion of all the money generated by the raffles went to the National Leukemia Foundation. The club enjoys help from Boy Scout Troop 30 of Stanton, DE, in manning the busy canteen and the Young Marines Unit from Middletown, DE, who handled parking-lot duties. An AMA Delta Dart building program also took place over the weekend, and it was open to anyone who wanted to try their hand at building one of the little rubber-band-powered free-flight models. Spectators came by

the busloads and numbered in the thousands!

A very large manufacturers' area was set up adjacent to the runway and the main pavilion. From kits and engines to props, glue and sunglasses, it was a regular RC flea market. Topping off the day's activities was a big Saturday evening barbecue. What more could a hungry warbird lover ask for?

ON THE FLIGHTLINE

Flying began at 8 a.m. and continued until 5 p.m.; at that time, the field became available for open flying. Five flight stations provided almost nonstop flight opportunities as long as your frequency pin was available.

The event was open to all IMAA-legal warbirds; monoplanes must have at least an 80-inch span, and biplanes must span at least 60 inches. Regardless of your taste in military "wingage," there was something for everyone. From Eindeckers, Bristol Scouts and Stearmans to Mustangs, Warhawks, Thunderbolts and B-25s, the sky was filled with serious warbirds.

Each day, I was able to put in four or five flights with my well-worn Piper L-4 Grasshopper. I even had an opportunity to fly other people's planes. My good friend and fellow warbird nut Sal Calvagna and his merry band of warbird lovers from the Long Island Aero Radio Society (LIARS) accounted for close to 40 airplanes. You couldn't throw a stick without hitting a warbird from Long Island! On several occasions, Sal allowed me (and several others) to fly his "pass-around" PT-19. We gave Sal's low-wing military trainer quite a workout. Thank goodness for 30-minute epoxy!

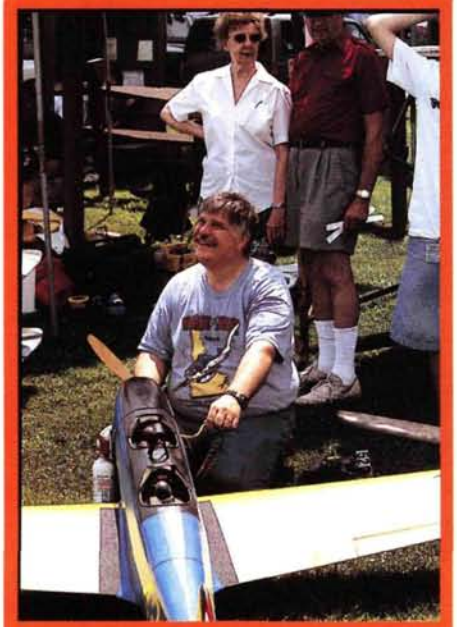
At every warbird meet, there seems to be an unspoken rule that there must be at least one battle for the champ of "How low can you go?" and this year, there were several excellent low-flying duels! My pick for low-flying champ was Ty Brown from Kannapolis, NC; he flew several impressive fighters, but the one that stuck in my mind the most was his beautiful green Japanese Zero. Built from scratch, Ty's big Rising Sun war machine had a 108-inch span and was powered by a Quadra 75. Equally as impressive was Trent Wilhelm of Salisbury, NC, who also flew several heavy-metal birds. His B-25 spanned 110 inches and was powered by two U.S. Engines 41cc powerplants that made you really sit up and take notice when he performed those down on-the-deck passes. Trent didn't spend much time on the ground; he also flew the wings off his super sweet Douglas AD Skyraider. This all-white, ground-support aircraft was loaded to the teeth with rockets and bombs. Spanning 100 inches and powered by a Zenoah G-62, Trent's "Sandy" put on quite a show!

Ty Brown makes a blistering flyby with his big Japanese Zero. Spanning 108 inches, the model is Quadra 75 powered.

Part of the noon flight show, this turbine-powered BVM F-4 Phantom jet was expertly piloted by Dave Malchione Jr. The 80-inch-long jet has a wingspan of 57 inches and is powered by a RAM 1000 turbine.

Not all landings are happy ones. Scott Bonomo's Brison 3.2 powered Mustang takes an

This ¼-scale Bristol Scout is a veteran of many Delaware Warbird meets. Flown by Robert Allen, the Scout has a 76-inch span and uses a Q-35 for power.



Over the course of the weekend, the ever-popular Sal Calvagna unselfishly offered his well-used PT-19 primary trainer to many pilots. He even repaired it a time or two. Everyone had a great time while they tried to make that perfect landing!

Each day the warbirds were lined up wingtip to wingtip so the spectators could get an up-close and personal look. Shown is only half of the lineup!

When it came to big smoky maneuvers, no one could beat Larry Ellis' F4U Corsair! Hailing from Chalfont, PA, Larry flew the pants off his big, blue, bent-wing warbird; he must have used up a gallon of smoke fluid. Built from Ziroli plans and spanning 93 inches, the Corsair was powered by a 3W-60 and weighed in at 32 pounds.

Flight sorties of the slower variety were also in abundance; WW I aircraft are always a big part of the Delaware experience. Well-known model designer and *Model Airplane News* contributor John Tanzer was on hand to show off his latest creation. Powered by a Quadra 40 and weighing only 18 pounds, John's 77-inch-span Sopwith Camel flies like a dream. If you'd like to build one for yourself, you're in luck. John's Sopwith fighter will be featured in a construction article in a future issue. Stay tuned!

Another very impressive Sopwith was built and flown by Kevin Shaw of Mid Island, NY. Kevin's Pup is a highly modified, kit-bashed Balsa USA kit, and it's powered by a Zenoah G-38. The 77-inch biplane's beautiful finish featured polished sheet metal side panels and engine cowl. Kevin's pilot figure was animated and could turn its head when the ailerons moved. Kevin did a great job flying his Pup as well.

unfortunate bounce during a gear-up landing. Scott said he'd have it repaired in no time!

Without a doubt, the largest airplane at the event was this wonderful 38-percent scale Curtiss Jenny. Built by Keith Zimmerly, the golden-oldie biplane has a 143-inch span and weighs 45 pounds. Covered in Solartex and using pull/pull cable controls, it is powered by a 3W-100 twin-cylinder engine. During a special demo flight, SKS Videos secured a small video camera to the top wing so they could film air-to-ground footage for a future video! At one point, Bill McCarty chased the Jenny around with his Fokker E-III Eindecker.

One of several North American P-47 Thunderbolts that bored holes in the skies over Lums Pond State Park.

WARBIRDS OVER DELAWARE SPONSORS

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Above: Kevin Shaw brings in his beautifully built, modified Balsa USA Sopwith Pup. The 77-inch biplane is powered by a G-38. Below: Bill McCarty's Fun Aero 80-inch S.E.5a British fighter was flown in many dawn patrol sorties during the weekend. It's powered by a Quadra 42.

LUNCHTIME BREAK

For half an hour every day, the flying was halted and all the models were lined up side by side down the length of the runway. This gave spectators a chance to see the warbirds up close and to speak with their proud owners. It was these breaks that made you appreciate just how many people attended the show; the crowd flooded the runway. After this wave of humanity subsided, the Delaware club orchestrated an impressive demo flight show.

Featuring highly aerobatic electric-powered models and a very impressive turbine jet flight, the crowd loved this mini show-within-a-show. Expertly piloted in true top-gun fashion, a bright-orange BVM F-4 Phantom jet powered by a RAM 1000 was an instant hit. Dave Malchione Jr. demonstrated the jet's blistering fast top-end speed as well as its "down-and-dirty" slow-speed flight characteristics. I'd estimate that its top speed was close to 190mph and that the low-speed flybys were in the neighborhood of about 45mph! How's that for a wide speed envelope?

The Delaware gang really takes their event seriously, and the outstanding way they run the show highlights the RC hobby and industry for all the participants and spectators who take in this warbird weekend.

It's impossible to fully convey the feel and flavor of Warbirds over Delaware using only photographs and words. To fully appreciate it, you simply must attend the event and see it for yourself; you owe it to yourself to see what all the excitement is about. Go ahead; pack up your warbird and head over to Delaware. I'll see ya there for sure! ✈

by Stan Kulesa

TOP FLITE

WINGS OF WAR

A Gold Edition kit of a classic warbird

As WW II came to a close, the Hawker Co. worked feverishly to release a new fighter-bomber—the Fury. The Royal Navy called it the "Sea Fury," and that name stuck. Although it saw minimal service in WW II, it was much used during the Korean War; in fact, a Sea Fury scored one of the first MIG "kills" during that conflict. This event merited special attention because a piston-powered airplane had shot down a nimble jet fighter.

As a military aircraft, it could carry up to 16, 3-inch rockets, two 1,000-pound bombs and two 90-gallon drop tanks under the wings in addition to its four 20mm Hispano cannon. The black and white stripes on the fuselage and wings were common to all British Commonwealth carrier-borne aircraft during the Korean War.

In 1949, the Sea Fury set a speed record on a flight from London to Rome, and this triumph gave rise to its principal civilian use as a racer; in fact, eight Sea Furys competed in the 1999 Reno Air Races, and the 1/7-scale, Top Flite-designed Gold Edition Sea Fury model that's the subject of this article is a replica of one of those racers.

PHOTOS BY STAN KULESA & DERON NEBLETT

SEA FURY

THE KIT

The large kit box contains: two rolled blueprints (one for the wing, stabilizer and elevator, and one for the fuselage, fin and rudder); rubber-banded stacks of balsa and plywood sheeting and strips; bagged hardware; a tissue-paper-wrapped, clear-plastic canopy; wire landing gear; assorted molded-plastic parts and a one-piece fiberglass cowl. I should note that the quality of the wood throughout this American-made kit is well above average; I didn't see any damage caused by shipping, and there wasn't any sign of warps or cracks. The die-cutting quality was excellent; all the parts were easy to identify. The 68-page instruction manual is comprehensive and includes construction details, "hot tips," facts about the Sea Fury's history, a parts list and an inventory of additional items required to complete the model. A set of miniature building plans is included in the instructions and makes a useful quick reference guide because you don't have to constantly unroll it. The photography throughout the manual is excellent.

CONSTRUCTION

Begin construction with the fin and rudder. Since they have airfoil shapes but are built on their sides over the blueprints, the main spar is cut oversize to account for its surface curvature. (Trim the excess spar but sand it later in the construction process.) Slot six, 1/16-inch balsa ribs into the 1/8-inch vertical balsa spar. Sheet the frame with 1/16-inch balsa, add a 3/16x1/2-inch balsa leading edge and two-layer, 1/4-inch-thick balsa tips and rudder bases, and sand them to the airfoil shape. (Later, you'll separate the rudder from the fin with a razor saw.)

The trickiest part of rudder construction is building the counterbalance, but this is just part of the process of building a scale model. I used Zap's thin CA for most of the construction, but I prefer its slow-curing CA for applying the sheeting.

The stabilizer uses 10, 3/32-inch balsa ribs slotted into an 1/8-inch balsa main spar. Like the rudder/fin, the stab/elevator has an airfoil shape, and the spar is oversize. You add the solid balsa tips and leading-edge material and sand them to the airfoil shape. Build the elevator in halves that will be connected by an 1/8-inch, one-piece wire joiner (that will be added after the fin and stabilizer have been permanently mounted on the fuselage). The elevators have a gentle, swept design.

To ensure rigidity and proper alignment, use 1/16-inch balsa to sheet the top of the empennage surfaces while they're still pinned to the building board. After you've removed them, sheet the empennage bottoms.

THE WING

The one-piece wing is constructed in three sections (center panel and two outer panels); when it's complete, it will have a polyhedral shape.

Several landing-gear options are available, but you must decide on one early in the game because the construction steps are different for each. The instruction manual illustrates alternatives, including fixed gear (provided in the kit), and suggests two choices of air-operated retracts (Robart and Century Jet). I opted for the Robart 605HD 90-degree retracts, and because I fly off a grass runway, I used the short-strut option. (The long-strut option is the proper scale alternative, but it's better suited to paved runways.)

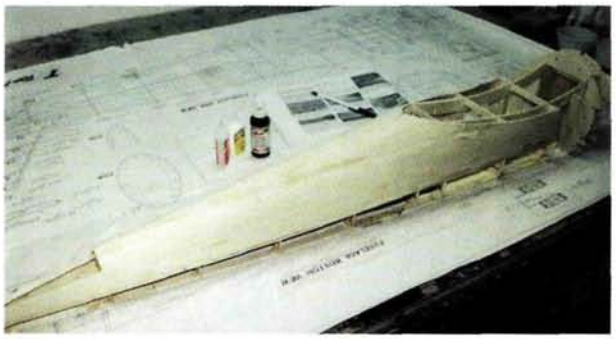
Begin the wings by making the skins out of 3/32-inch balsa sheeting; then, when you've completed the framing, you'll be ready to fully sheet the wings. Next, prepare the center section's 3/32-inch balsa ribs by epoxying several with 1/8-inch plywood doublers (to handle the stresses imposed by the landing gear). I used Zap's 5-minute epoxy for this and to attach the 3/8x1/2-inch maple retract mounting rails to the ribs after I had installed them. Nine ribs make up the center section. The top and bottom main spars consist of two, joined, 3/16x1/8-inch balsa and basswood strips. To ensure that the construction is square, the ribs fit neatly into slots on an 1/8-inch balsa center trailing-edge spar. This center trailing-spar is oversize so that the airfoil-shape framing can be added while it's still pinned to the building surface. Like the empennage, the top half of the wing is sheeted while it's attached to the building board. After you've removed it, add fiberglass cloth to the interior of the wheel-well area for strength and easy maintenance (I used 3/4-ounce Hobbico fiberglass cloth).

The two wings' outer panels are constructed in the same way as the center section. Each outer panel has seven, 3/32-inch ribs with lightening holes that make it a bit easier to snake the servo wires through.

You must decide whether to add scale flaps. I encourage you to do so, not only because of their scale appearance but also because they markedly enhance the Sea Fury's slow-flight performance. This process is somewhat complex, since the flaps extend both to the center panel and to the outer panels, but Top Flite's superior engineers took this into consideration when they designed a joining process that works well yet limits the servo requirements to two (one for each flap).

The flaps are constructed of half ribs. Unlike the other flying surfaces, which are attached with CA hinges, the flaps are attached with pin hinges to maximize their throw and strength.

The three wing panels are attached to one another with two, doubled 1/8-inch plywood wing joiners that fit neatly into grooves in the interior spar section. Each



Fuselage framing is done upside-down. Several sizes of balsa stringer material run through notches in the formers to help create the rounded frame onto which the 3/32-inch balsa sheeting is applied.

SPECIFICATIONS

MODEL: Sea Fury

MANUFACTURER: Top Flite

DISTRIBUTOR: Great Planes Model Mfg.

TYPE: scale warbird

WINGSPAN: 66 in.

WING AREA: 842 sq. in.

WEIGHT: 11 lb., 9 oz.

WING LOADING: 31.6 oz./sq. ft.

ENGINE REQ'D: .61 to .91 2-stroke or .91 to 1.20 4-stroke

ENGINE USED: O.S. Max FS .91 Surpass II 4-stroke

PROP USED: APC 14x8

RADIO REQ'D: 4- to 7-channel w/5 to 8 servos (elevator, rudder, throttle, ailerons; optional flaps, retracts)

RADIO USED: Airtronics RD6000 w/6 Airtronics dual-ball-bearing servos (elevator, 2 ailerons, 2 flaps, rudder) and 2 Tower Hobbies universal servos (throttle, retracts)

FUEL USED: Tower Hobbies 15% for 4-stroke engines

PRICE: $159.95

FEATURES: balsa/plywood construction; well-detailed, rolled blueprints; 68-page instruction manual; decals; one-piece fiberglass cowl; ABS molded parts; clear canopy and assorted hardware.

COMMENTS: highest compliments to the intelligent engineering and above average quality of the materials in this kit.

HITS

- CAD-engineered interlocking construction ensures solid, accurate assembly.
- Well above average-quality wood used throughout.
- One-piece fiberglass cowl.
- Exceptional engineering apparent in many phases of construction.

MISSES

- Rudder and elevator servos are difficult to access.

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

I was pleased with the Sea Fury's ground handling. The takeoff roll was very controlled; it required a little right rudder and a bit of up-elevator. The tail lifts off the ground with full throttle, and in about 40 to 50 feet, it's airborne. The climb-out was gradual at 20 degrees.

Trim adjustments included three clicks of down-elevator and two clicks of right aileron. When these adjustments had been made, the Sea Fury tracked very solidly. The power of the O.S. Max 91 Surpass wasn't so overwhelming that it caused the model to fly at a non-scale speed.

Landing approaches are routine; the Sea Fury is lined up at the end of the runway, the throttle is gradually lowered and the model settles nicely. With full flap extension and some gentle down-elevator, I enjoyed a slow, controlled landing speed.

AEROBATICS

Loops with a diameter in excess of 100 feet were solid; stall turns, Immelmanns, split-S's, Cuban-8s and other vertical maneuvers were achieved with distinction. The roll rate was nearly two per second at high rates and one per second at low rates. Snap rolls (both left and right) were sluggish but clearly defined. Spins were brisk; the model's nose almost pointed at the ground, and recovery was easy. Inverted spins were a bit wider. Inverted flight required moderate down-elevator; I was not successful with inverted loops (the right wing panel always dropped). Knife-edge flight was achieved with moderate rudder; knife-edge to the left gradually decreased its altitude, though.

SLOW-SPEED PERFORMANCE

Slow-flight performance didn't produce any surprises; all the flying surfaces remained highly responsive. With full flap extension and low throttle, the Sea Fury slowed to a crawl. Remember to maintain sufficient airspeed with full flaps to grease it in for a landing.

HIGH-SPEED PERFORMANCE

The full-scale Sea Fury is frequently used as a Reno Racer, so you know the model's high-speed flight is going to be fun! It tracks straight and true, and—just like its big brother—it holds its position in a tight bank.

wingtip is propped up 1½ inches; I used Zap 30-minute epoxy for this.

FUSELAGE

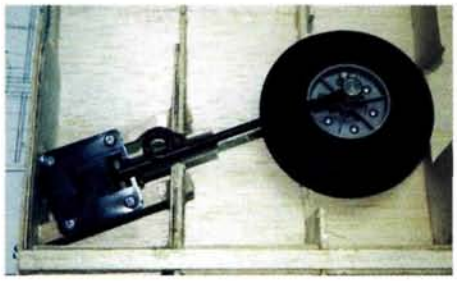
The fuselage is framed upside-down. Begin by building an ⅛-inch plywood deck and crutch assembly, and then fit the bottom half of the formers into it. The fuselage side section over the wing area uses doubled ⅛-inch plywood to handle the stress to which it will be subjected. The firewall is constructed of doubled ⅛-inch birch-plywood pieces, and the fuselage is made up of 11 formers.

To help create the rounded frame onto which you'll apply the 3/32-inch balsa sheeting, run several sizes of balsa stringer material through notches in the formers. I used thick Zap CA to glue all of the balsa-to-plywood joints, but I used slow-curing Zap CA to attach the sheeting to the fuselage frame. The best way to ensure that the fuselage is straight is to apply the sheeting to the bottom half of the fuselage while it's still attached to the building surface.

It's usually tough to apply sheeting to a rounded fuselage, but wetting the sheeting first makes it very pliable. Don't be concerned about gaps where two sheets are joined; Hobbico filler dries quickly, is easy to sand and works great.

The tailwheel assembly is in its scale position; for this reason, a separate wire pushrod has to be run from the interior to the aft end of the fuselage. The instructions suggest that you connect this tailwheel pushrod to the rudder pushrod with a wheel collar, but I thought this wouldn't adequately withstand vibration, so I opted to solder them together instead. The tailwheel assembly is installed during the early stages of fuselage construction.

The Sea Fury is ready for final sanding and covering.



Several landing-gear options are offered. The manual illustrates alternatives that include fixed gear (provided in the kit) and two choices of air retracts. I opted for the Robart 605HD 90-degree retracts.

Attach the wing to the fuselage after you've trimmed the sheeting around the wing-saddle area. The wing is held in place by two, ¼-inch dowels that protrude from the leading edge and by two, ¼-20 holding wing screws. After the wing has been properly fitted, remove it, cover the center section with wax paper, and then reattach it so you can construct the wing fairings. Each fairing has six die-cut fillet braces of the appropriate shape. Glue these fillet braces to a 1/32-inch plywood plate on the curve of the fuselage's wing-saddle area and to the exterior sheeting; then glue a die-cut, 1/16-inch balsa sheet over the fillet braces.

Before you cover the model, permanently attach the empennage to the fuselage. I used Zap 30-minute epoxy so I would have enough time to properly align the surfaces. My Hobbico builder's squares were useful when I set the proper alignment.

Fit and then glue the two molded-plastic air intakes to the inboard leading edge of the wing while it's attached to the fuselage. Use scrap wood to fill any gaps and Hobbico filler to make the ends flush with the wing's surface. After you've mounted the engine, fit and attach the one-piece fiberglass cowl using six screws that go through holes in hardwood blocks epoxied to the firewall. I used a Dremel Moto-Tool to make the cutouts in the cowl for the engine head, the muffler exhaust and the fuel valve.

RADIO & ENGINE

The model calls for the following combination of servos: one each for the rudder, elevator, throttle and retract system, and two each for the ailerons and flaps. To state the obvious: if you choose to build the Sea Fury without retracts or flaps, it will affect the number of servos you need. Install the rudder and elevator servos while you're building the fuselage framing (before you sheet it). Access to these servos is through die-cut holes in the wing-saddle plywood, and it's "challenging" to reach them.

The throttle and retract-system servos sit in an ⅛-inch plywood tray secured to the fuselage sides. Attach each of the two aileron and flap servos to its own removable ⅛-inch plywood hatch; the ¾x⅞-inch maple servo-mounting blocks are epoxied to the hatch.

You need two 18-inch servo extensions and a Y-connector for the aileron servos. For the flaps, I used a Maxx Products electronic servo-mixing device called the "Miracle Y" so they'll lower simultaneously when they're activated.

I used Airtronics 743 double-ball-bearing servos for the elevator, ailerons, flaps and rudder because they provide 72 oz.-in. of torque, and I used Tower Hobbies universal servos for the throttle and retract systems because of their low torque requirements. The easy programming offered through my Airtronics RD6000 radio brought everything together and allowed me to mix flaps with elevator control, etc.

Use a 2- or a 4-stroke engine. If you opt for the 4-stroke, mount it vertical and inverted; if you go with the 2-stroke, tilt it slightly to allow the muffler to exit. I powered the test model with an O.S. Max FS .91 Surpass II 4-stroke engine (with its stock muffler) and chose an APC 14x8 propeller and a 4-inch, C.B. Associates white nylon spinner. Mount the engine on the Great Planes adjustable fiberglass engine mount that comes in the kit. I used my Great Planes Dead Center Hole Locator to ensure that the engine's screw holes would be aligned with the engine mount's. I used a Sullivan 14-ounce fuel tank and a Du-Bro Kwik Fueler valve. By the way: I got an incredibly reliable idle with the pumped engine, and I strongly encourage you to consider this alternative.

FINISHING

I needed two rolls of Dove Gray and slightly more than one roll of Insignia Blue MonoKote to cover the model. You'll also need Top Flite LustreKote spray paint to match these two colors on the cowl, the air scoops and a few other parts. To trim the black and white stripes around the fuselage and wing, I used MonoKote I had in storage. Stick-on decals with the Canadian maple-leaf insignia, aircraft numbering/lettering and a few other odds and ends are provided in the kit. I used a Top Flite Panel-Line Pen to add more detail, and I applied two light coats of LustreKote clear to help protect the "panel lines" from spilled fuel.

The Sea Fury is a scale model, so I strongly encourage you to consider buying the cockpit kit that Top Flite designed for it; it's inexpensive and adds awesome details, including an instrument panel, headrest, sides, seat and floor. I also chose to add a 1/7-scale, full-body Top Flite pilot. If you're up to it, the manual sets out easy steps to build a static, 5-blade prop. Of course, if you choose this option, you'll need a second spinner for flying. A clear-plastic canopy is provided; its frame must be lightly sanded and painted. I used Formula 560 glue to attach the canopy to the fuselage.

The builder is offered two engine-mounting techniques: one for 2-strokes and one for 4-strokes. I chose to power the test model with an O.S. Max .91 Surpass II pumped 4-stroke engine with its stock muffler.

The elevator and rudder servos are tucked inside the wing fillets; be sure to install them before you sheet the fuselage!

CONCLUSION

Before I started to build the Top Flite Sea Fury, I had completed several ARFs, and I must say that it was truly a good feeling to get back to building a kit. There's nothing quite like the sense of accomplishment that building brings. Of course, the Sea Fury requires a lot of building and a considerable time commitment, but the results are hugely satisfying. Top Flite's Gold Edition warbirds represent some of the finest flying, best-looking and most intelligently engineered scale models available today. ✈

PHOTO BY JOHN DIBBS

FURIOUS SEA FURY: LAST OF A BREED

All good things come to an end, and for British, propeller-driven fighters, the end was the fabulous Hawker Sea Fury. It embodied everything that country had learned about fighter design and was a worthy successor to the Spitfire and Hurricane.

Based on Hawker's tank-busting Tempest Mk. III, the 1944 design ended up as a 9,200-pound behemoth (empty weight)—2,000 pounds more than a P-51D. It was powered by an 18-cylinder 2,480hp Bristol Centaurus engine that was unique not only because of its power but also because it was of a "sleeve valve" design. This design replaced the tulip-shaped intake/exhaust valve arrangement most engines used with a wildly complicated sleeve valve that resembled the valves in a trumpet. The engine's complexity is one reason so many restored Sea Furys use Wright R-3350s for power.

Although it's massive, the airplane is a pilot's delight with light, quick controls and an exhilarating takeoff acceleration that's matched by only a few others. Too late for WW II combat, the fighter versions—the F. Mk. X and the fighter-bomber FB Mk. II—were more than a match for most opponents. During the Korean War, at least one MiG-15 pilot made the mistake of battling a Sea Fury in a turning fight—and lost.

Third-World air forces flew the Sea Fury well into the '80s, and many of those we see restored saw service in Pakistan and Iraq. A total of 860 single-seaters were produced along with 60 Mk. 20 two-seat trainers.

—Budd Davisson

Editor's note: Budd Davisson is the editor-in-chief of* Flight Journal*; he is an expert pilot who has flown many WW II fighters.

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HOUSE OF BALSA ELECTRIC ACRO CUB

GREAT BUILD, ELECTRIFYING PERFORMANCE

by Randy Randolph

PHOTOS BY RANDY RANDOLPH & DEBRA CLEGHORN

If you like to build your own planes and want a great-flying electric park flyer, take a look at the House of Balsa Electric Acro Cub. Scale purists need not apply; this plane was designed to perform, not to win static contests! Folks who like to build kits as much as they like to fly them will really enjoy this model; this is a good kit!

FIRST IMPRESSION

The plywood and balsa are top-notch, the entire kit has excellent laser cutting, rolled full-size plans, a very well-photographed instruction manual, a complete Du-Bro hardware package, pre-formed aluminum landing gear and a nice-looking self-adhesive Mylar decal sheet. House of Balsa recommends three different power sources: a Speed 400 or the brushless AstroFlight 010 or 020. I opted for the AstroFlight 020, and it was an excellent choice.

Every modeler has his own way of approaching a building project, and every kit manufacturer assumes the builder has a certain level of competence. The logical sequence of the manual facilitates proper construction of the plane. With that in mind, the only way to give an accurate review of the Acro Cub is to build the kit according to the manual directions, and that's exactly what I did!

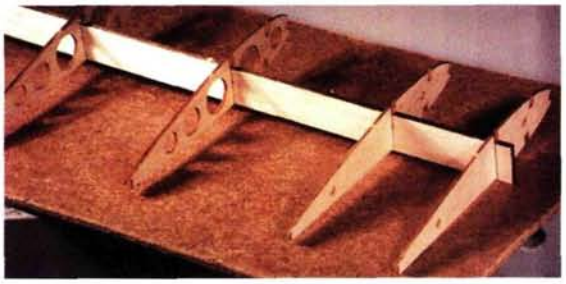
WING CONSTRUCTION

The wing panels build right over the plans and are designed so the semisymmetrical rib section will fit between the trailing edge and the main spar as if it were a flat-bottomed section. Each rib has a notch to fit into a corresponding notch in the laser-cut main spar. This assures quick building, proper spacing as well as upright placement of each rib. Now, with each panel pinned to the building board, I glued on the top spars and leading edge and followed the well-documented sequence illustrated in the manual.

Once the wing panels are complete and the center sections of each have been sheeted (both top and bottom), the panels are joined to form the wing. At this point, I installed the aileron hardware and trimmed the ailerons to fit. I did not hinge them until the wing was covered. For years, I have used a tool, which is a piece of 6-inch long, ⅛-inch wire that is glued into a ½-inch dowel handle. The free end is ground flat to make a dandy gouge. I use this tool to cut the grooves in the aileron trailing edge for mounting the control hardware.

FUSELAGE CONSTRUCTION

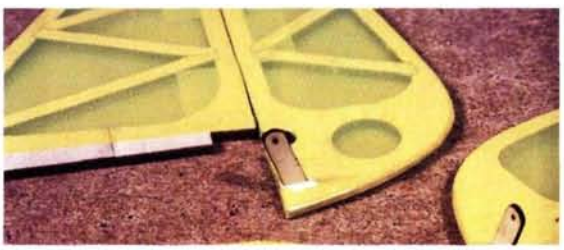
Fitting the two fuselage sides is like piecing together large, easy-to-identify parts of a jigsaw puzzle. On completion, the two sides have laser-cut notches; these are joined with the formers and bulkhead, which have the matching keys that fit the notches. Strict adherence to instructions eliminates any pitfalls in the assembly process.



The laser-cut ribs and spars fit together like puzzle pieces to provide a full-depth spar—light yet still strong! The wing should be completed over the plan.

All spars are trimmed flush with the center rib, and the two holes are laser cut for ⅛-inch dowels, which fit into the center rib on the other panel to ensure a perfect fit of both panels at the center joint.

Plywood doublers on either side of the firewall fit together like a jigsaw puzzle and are best held in place with clamps or clothespins until the glue sets.



Ply control horns are provided and are glued through laser-cut notches in the rudder and elevator. They are slanted so the hole is directly over the hinge.

MOTOR INSTALLATION

Since more than one motor/gear combination can be used to power the Acro Cub, motor mounts for the Speed 400, AstroFlight 010 and 020 brushless motors are included. You'll need to choose which motor you're going to use before you start to build; the manual details a different assembly sequence for each mount as well as any changes that must be made during the fuselage assembly.

SPECIFICATIONS

MODEL: Electric Acro Cub

MANUFACTURER: House of Balsa

TYPE: high-wing aerobat

WINGSPAN: 52.5 in.

WING AREA: 350 sq. in.

WEIGHT: 27.5 oz.

WING LOADING: 11.3 oz./sq. ft.

LENGTH: 27.5 in.

DRIVE SYSTEM REQ'D: Speed 400 geared motor or AstroFlight 010 or 020 geared brushless

DRIVE SYSTEM USED: AstroFlight 020 geared brushless

SPEED CONTROL: AstroFlight 25A brushless sensorless

RADIO REQ'D: 4-channel micro radio w/3 servos (elevator, rudder and ailerons)

RADIO USED: Hitec transmitter, GWS 4-channel receiver and assorted microservos

BATTERY INSTALLED: 8- or 10-cell, 800mAh NiMH

PRICE: $74.95

FEATURES: laser-cut balsa and plywood constructions; full-size CAD plan; color, photo-illustrated manual; includes full hardware package including pre-formed aluminum landing gear.

COMMENTS: the pieces of this kit fit together extremely well and result in a nice park flyer that can double as an aerobatic aircraft.

HITS

- High-quality laser-cut wood.
- Good plans and instruction manual.
- Complete hardware package.
- Straightforward assembly.

MISSES

- None.

Left: the firewall is laser cut to match the AstroFlight 020 brushless motor. Another firewall is provided to mount different motors. Right: there is plenty of room for radio gear in the cabin area and lots of laser-cut holes that make it easy to connect the various elements of the motor and radio.

FLIGHT PERFORMANCE

With the AstroFlight 020 brushless motor installed, the Acro Cub might be called a two-way airplane, a park flyer, or an electric fly-at-the-field aerobat! The only distinction is the size of the battery pack! With 8 cells, the Acro Cub is a good flying sport-type airplane that will take off from grass and turn tightly enough to easily stay within the bounds of a ball field. Use a 10-cell battery pack, and the Acro Cub becomes an extremely aerobatic performer.

TAKEOFF AND LANDING

With a 10-cell battery, about 15 feet of roll and a climb-out better than 45 degrees, takeoff is more of a leap-off! After a few laps around the field, I set up for the landing. This is a clean airplane with a good glide pattern; keep that in mind when landing. Just cut the power and let the plane settle in, keeping the wings level until just before touchdown. Flare a little and the plane will settle in perfectly and make you look like an expert. Use throttle control to adjust your flight path, if needed.

LOW-SPEED PERFORMANCE

Low speeds are no problem; the Acro Cub will cruise around all day at ¼ throttle or until the battery runs out of juice! The Cub has a tendency to drop a wing slightly (and I do mean slightly) when it stalls, but once the nose drops, the wing will level out and glide straight ahead. For a high-performance plane, its stalling characteristics are very mild.

HIGH-SPEED PERFORMANCE

The Acro Cub cruises nicely at ¾ throttle and will do loops and stall turns. At full power, this plane becomes ballistic. Just about any other types of maneuvers you want to do are possible. This plane will not perform these aerobatics with the look of an Edge 540, but it's cool to watch it perform all of these stunts with a Cub flavor.

AEROBATICS

The Acro Cub is an agile and powerful performer; its bag of tricks includes rolls, inside and outside loops, inverted snaps and spins. However, even with all of its power, it is still a Cub, and all of these maneuvers (which no full-scale Cub could ever perform) do have a Cub-like quality.

When assembly is complete, you should have a light yet strong fuselage, thanks to the clear and detailed instructions of a well-engineered kit.

TAIL FEATHERS

I was able to put together these built-up tail surfaces faster than any others I have ever built! The entire outline of stab, fin, elevator and rudder are laser cut, and so are the ribs that flesh them out. Actually, the whole tail assembly can be put together without the plans; a flat board and some pins are all you really need. The pieces will still fit together well, but it is best to follow the plans to ensure proper construction.

FINAL ASSEMBLY

Once the assembly of the major components was complete, I sanded everything with 150-grit sandpaper and used the 220-grit for a nice finish. Then, when all the surfaces were smooth, I cleaned the framework with a tack rag—now the airplane is ready to cover!

Normally, the ideal covering would be something with a light film, but since I had a roll of transparent MonoKote handy, that was the covering of choice! Although hinges are provided in the kit, I opted for my favorite MonoKote hinges, which have stood me in good stead over the years. Pictures of the finished airplane, featured on the box and in the instructions, boast a dandy sunburst color scheme. That trim scheme was not included in the kit, so I decided to trim the plane with the decals provided, which made it look like a J-3 Cub.

A large area under the cabin is provided for the flight batteries. There is plenty of room for the recommended 10-cell pack.

Larger wheels are recommended as replacements for smaller wheels and pants when flying from grass fields.

That's me launching the Acro Cub on my local school ground.

Because I intended to fly my new plane at a local schoolyard, I used the GWS 4-channel receiver with three microservos, saving an ounce or so of weight.

The manufacturer recommends using bigger wheels, if you choose to fly the airplane from a grassy field. I built up and finished the provided wheel pants because they look so good, but when it actually came time to fly, I switched to larger wheels that actually looked more Cub-like. The bigger wheeled airplane with a 10-cell, 800mAh pack weighed 27.5 ounces ready to fly—2.5 ounces less than listed in the specifications!

A very nice feature of this kit is easy battery installation. When the bottom of the cabin is open, the batteries slip nicely into the wide opening. I shimmed with a little foam and held the batteries in place with hardwood dowels. This provides a lot of air circulation (which is nice to have in the middle of summer) and allows easy battery removal for charging.

Another benefit is that the battery pack can be positioned to properly balance the airplane (incidentally, the pack goes almost ½ inch in front of the main spar!).

CONCLUSION

I set all of the controls in accordance with the manufacturer's recommendations and charged the battery. The Acro Cub was ready for the park. I expected the Acro Cub to be a great flyer, and my first flight confirmed my expectations. It is a fantastic plane to fly, even with an 8-cell pack, but with a 10-cell pack, its performance is outstanding. It is nice and easy to build and fun to fly, and what can beat that? ✈

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CANTERBURY SAILPLANES F-20

Scale soarer with striking appeal!

TIGERSHARK

by Norm Bogenschild

PHOTOS BY JOHN REID

If I had to choose one word to summarize the Canterbury Sailplanes F-20 slope glider, it would be "striking." Its aggressive look and smooth flight characteristics make this plane a joy to own and fly. The F-20 is easy enough for a beginner to fly, but it will still hold the interest of experienced pilots.

The EPP-foam kit was easy to assemble and has proven to be extremely durable. Some combat action put the plane's durability to the test, and it came out completely unscathed!

SPECIFICATIONS

MODEL: F-20 Tigershark

MANUFACTURER: Canterbury Sailplanes

TYPE: slope combat glider

WINGSPAN: 39 in.

WING AREA: 269 sq. in.

WEIGHT: 21.8 oz.

WING LOADING: 11.7 oz./sq. ft.

LENGTH: 35½ in.

RADIO REQ'D: 2-channel w/2 servos (elevator and aileron)

RADIO USED: Hitec Flash 5 transmitter, a Hitec 555 receiver and 3 Hitec microservos (optional flaperons)

AIRFOIL: semisymmetrical

PRICE: $79.99

FEATURES: precision-cut EPP foam-cores; fiberglass spars; Corflute tail surfaces; all necessary hardware, rolls of nylon-reinforced tape, red packing tape and Bostik Clear Bond glue are included.

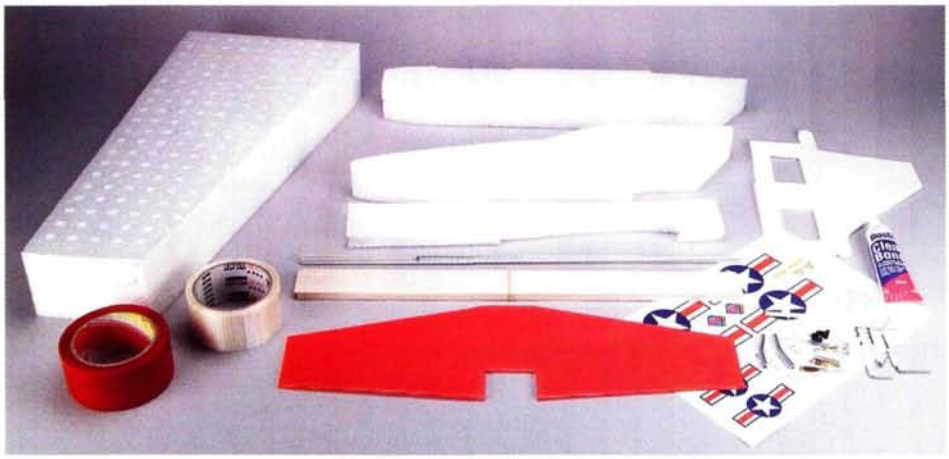
COMMENTS: the F-20 Tigershark is a nearly indestructible plane that exhibits excellent performance. It is well suited to both beginners and experts.

HITS

- Nicely cut wing-cores.
- Easy to assemble.
- Extremely durable.

MISSES

- Decals not self-adhesive.



KIT CONTENTS

When I opened the box, I was pleasantly surprised that almost everything needed to build the plane is included. The 16-page instruction manual is very complete but lacks illustrations that would have been very helpful in a few key steps. A separate diagram shows the radio installation.

The majority of the aircraft is constructed of precision-cut EPP foam. The fuselage comes in four pieces—two cut to the outline of the side view and two cut in the shape of the intake ducts.

The EPP wing-cores come with precut spar reliefs that are some of the best I've seen. The package also includes four fiberglass wing spars and aluminum spar joiners. The precut tail surfaces are constructed of Corflute material, and the cuts are all very clean and uniform. The hardware package contains everything you need to complete the F-20.

ASSEMBLY

Wings. Following the instructions, I started with the wing. I glued the two wing-cores together using 3M 77 spray adhesive and joined the two sets of fiberglass spars with the prebent aluminum joiners and the supplied glue. The angles of the prebent joiners needed a slight adjustment to fit properly, so I bent them to the correct angle using pliers.

Although the wing-cores come precut for the spars, you must remove additional material in the center of the wings to accommodate the aluminum joiners. I have found that by installing a paper clip in the tip of my electric soldering iron, I can form a foam-cutting tool in a number of different shapes. I used my improvised foam cutter to relieve the center of the wing.

After I had test-fit the spars and ensured that everything was flush, I glued the spars into the cores following the instructions. They must be allowed to dry for 24 hours before any more work can be done.

Next, I applied the nylon-reinforced strapping tape to the wing according to the pattern on the outline drawing. I then covered the wings with Top Flite EconoCote. I chose this material in place of the provided red packing tape because it provides a much nicer finish and is specifically designed to be applied at low temperatures.

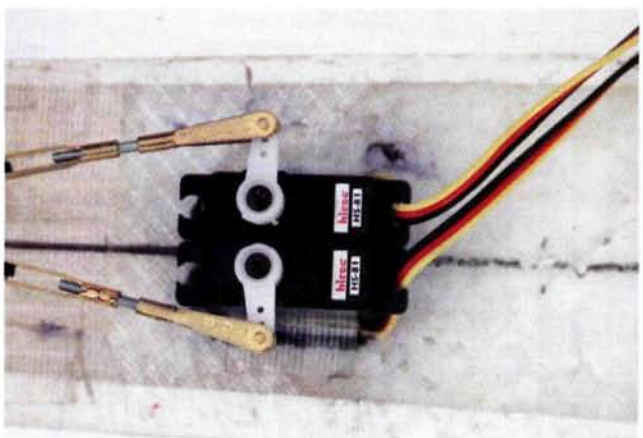
I cut the ailerons to length and then covered and attached them using a strip of covering material; this is very similar to the suggested method outlined in the instruction booklet. At this point, I set the wings aside to begin construction of the fuselage.

Fuselage. To assemble the fuselage, I first glued the two center sections together and applied a strip of nylon-reinforced strapping tape to each side. This allowed me to shape the center section. I used a wood rasp and some 80-grit sandpaper to round the edges and create the F-20's smooth contours. The directions suggest that you do this with a hobby knife, but I don't recommend that; it's too easy to cut off more than you bargained for.

After I had shaped the center of the fuselage, I installed all the radio gear. This was out of sequence, but had I followed the instructions, I would have had to cut through the covering material to install the gear.

I glued the two intake ducts to the sides of the fuselage and carefully sanded them into shape. Then I applied the nylon tape to the entire fuselage according to the instructions. I used a hot covering iron to smooth the tape over the compound curves and applied EconoCote covering over the nylon tape to produce the finish shown. Black automotive pin-striping tape separates the red and white color scheme.

During the covering process, I accidentally melted a small section of the canopy by allowing my covering iron to become too hot. To repair it, I removed the affected material, applied some spackling putty then reshaped and recovered the damaged area.



I mounted the on/off switch to a piece of 1/64-inch plywood before I mounted it on the side of the fuselage.

ADDED PERFORMANCE

I'm the kind of modeler who always tries to improve on an already good design, so I decided to make use of the flaperon function on my Hitec radio and see how the F-20 would handle with the added feature. Flaperons allow a pilot to actuate the ailerons like flaps while maintaining aileron control; this requires that you install an extra servo, but because I chose microservos, the weight difference is negligible. (I weighed two full-size servos against three microservos and found very little difference.) The Hitec Flash 5 radio allows me to actuate the flaperons with the throttle stick, making them variable from neutral to about ½ inch of deflection. The radio also mixes in the elevator to compensate for any pitching moment that the flaperons create. It took a few trials until I figured out that level flight requires 10-percent up-elevator mix when the flaperons are actuated.

So how do they work? Spectacularly! The directions suggest that you set up the ailerons with a 1/16-inch reflex, so I set the neutral position at 1/16 inch up and the down position at about ½ inch below that. At about ¼ deployment, the wings generate incredible lift and slow the plane slightly; this makes it possible to keep the F-20 aloft in winds that would normally ground a typical slope combat glider. Full deployment slows the F-20 for landings in a hurry, but the aileron control becomes mushy. Rolls are very axial in neutral and become more barrel-shaped when you actuate the flaperons.

I have had limited success using flaperons on other slope combat planes, but I highly recommend them for the F-20.

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

The F-20 takes off with a simple toss off the side of your favorite slope-gliding hill. The plane tracks straight and requires no input to keep the wings level. Surprisingly, the F-20 can be flown in very light wind and has flown decently in wind as light as 8mph.

Landing the F-20 is a piece of cake. The plane will glide for quite a ways after you are out of the lift zone, and it has a straight-ahead stall characteristic that makes touchdowns very gentle. The EPP construction is extremely forgiving and has even absorbed a few cartwheel landings with little more than a few grass marks.

HIGH-SPEED PERFORMANCE

The F-20 is one of the fastest EPP foam planes I have flown. The plane tracks straight and does exactly what you tell it to do. The semisymmetrical airfoil and smooth EconoCote covering allow the F-20 to really move. I did not observe any aileron or elevator flutter at high speeds.

LOW-SPEED PERFORMANCE

If you enjoy a more relaxed airspeed like I do, simply pull the elevator trim back a little. The F-20 has a very slow stall speed, making it simple to keep up at slow speeds. It requires slightly higher control inputs at low airspeeds.

AEROBATICS

Although most 2-channel combat slope gliders are not known for spectacular aerobatics, the F-20 will perform axial and barrel rolls very nicely, with minimal loss of airspeed. Loops require some aileron input at the top to prevent the F-20 from falling out to one side. Stall turns are smooth, thanks to the large vertical fin.

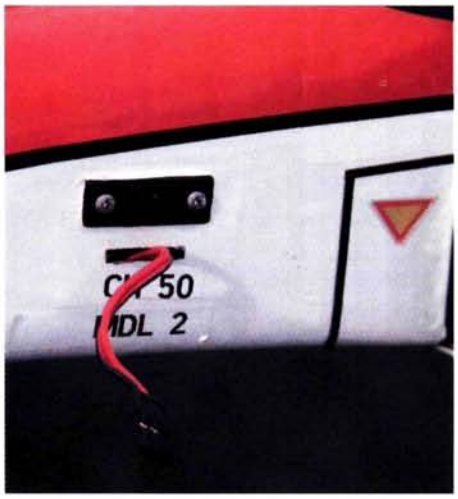
This plane does not like to fly inverted; it requires almost full down-elevator and loses airspeed in a hurry. The first few attempts at inverted flight resulted in a little durability testing and a hike down the hill. Flat spins are possible if you are lucky enough to find another combat plane heading in your direction and are skilled enough to touch wingtips. Be prepared for a hike, though, because the plane won't recover from a flat spin unless it is at high altitude. Be sure that the other pilots on the hill are combating before you try this!

Tail surfaces. The tail surfaces come precut from Corflute material. The vertical fin was white and the horizontal stabilizer was red, but the color scheme I desired required the vertical fin to be mostly red. Because Corflute cannot withstand the temperatures required for iron-on covering to adhere, I used a sheet of self-adhesive covering material from Top Flite that matched the color of the EconoCote to make the vertical fin red. The horizontal stabilizer and elevator required little more than installation of the provided hardware. I glued both tail surfaces to the fuselage using the supplied Bostik glue.

Radio installation. The F-20 requires only a 2-channel radio to operate the ailerons and the elevator; I chose the glider version of the Hitec Flash 5 computer radio because I wanted to try its flaperon function with the F-20. The package includes three microservos, a mini Hitec 555 receiver, a power switch and a 270mAh flight pack.

Since the flight gear is basically built into the aircraft, I installed everything in the fuselage before I covered it. Glue the servos directly to the EPP foam using the provided glue. Because the fuselage is precut for full-size servos, I had to use a few scrap foam pieces to shim my micro elevator servo into place. The radio-gear locations are clearly marked on the outline drawing provided with the instructions.

I mounted the on/off switch on a scrap piece of 1/64-inch plywood. I also cut a slot in the plywood that allows the charging jack to be tucked away. I cut the recesses into the fuselage for the receiver, the battery and the switch using a hot wire. Instead of cutting slots into the surface of the fuselage to route the wires through, I used a piece of 1/8-inch music wire heated over a torch to very carefully melt wire conduits through the fuselage. The conduits are only slightly larger than the servo connectors, and should I ever decide to use the flight gear in another plane, the conduits will make removing the radio gear much easier.



I glued the Hitec servos directly to the EPP foam. Because the fuselage was precut for standard servos, I had to use a few pieces of scrap foam to shim the microservos into place.

Next, I mounted two microservos side by side into a recess that I cut into the wing and secured them into place using glue and some nylon-reinforced tape. Of course, I carefully checked the control-surface throws, aileron and flaperon functions before I glued the wing to the fuselage.

BALANCING

The F-20 required about 2½ ounces of lead in the nose to balance at the location indicated in the instructions. I also checked the balance along the axis of the fuselage, and one wingtip needed almost ¼ ounce. I cut a slot in the wingtip and inserted an appropriate-size washer. The F-20 was then ready to take flight.

CONCLUSION

Because I was so meticulous about the finish, it took me about 12 hours to complete the F-20. If, however, you don't have your heart set on matching the color scheme on the box, you could definitely finish it much more quickly. Once complete, this glider is striking; and if you think its looks are pretty cool, wait till you get it in the air!

Canterbury Sailplanes; www.flycs.com.
EconoCote; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; greatplanes.com.
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禅 Zen - 120

No.: A112

SPECIFICATIONS

Wing Span: 71.0 in / 1800 mm
Wing Area: 955 sq in / 61.6 sq dm
Flying Weight: 10.0 lb / 4500 g
Fuselage Length: 71.5 / 1820 mm
Engine Required: 4C 1.20 cu in
Radio Required: 5 channels, 6 servos

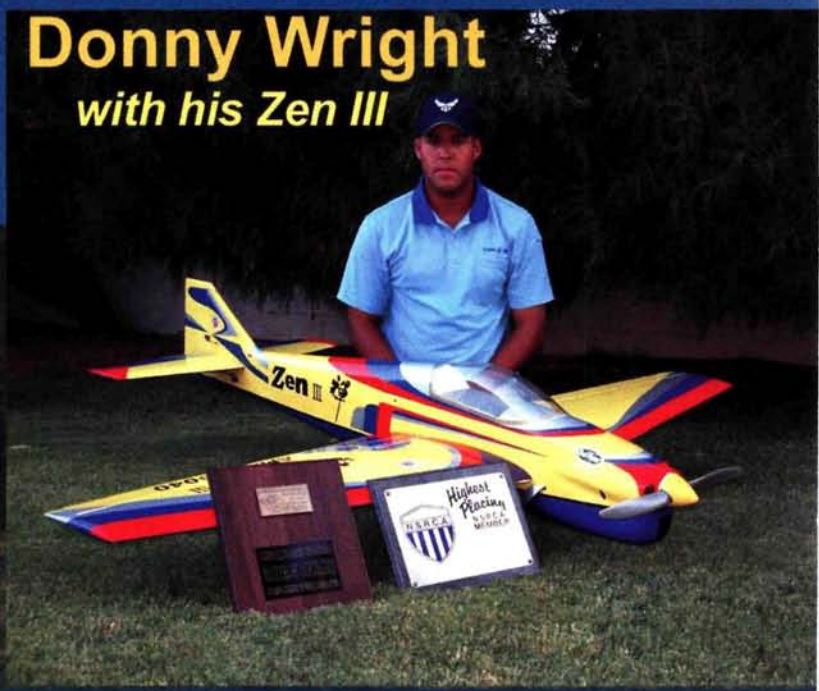
Aluminum Spinner

3-D transparent template

Anit-vibration engine mount comes with blind nuts already installed at the firewall

Inside the fuselage

Tune-pipe can be installed under the latched fiberglass belly pan



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All necessary hardwares included

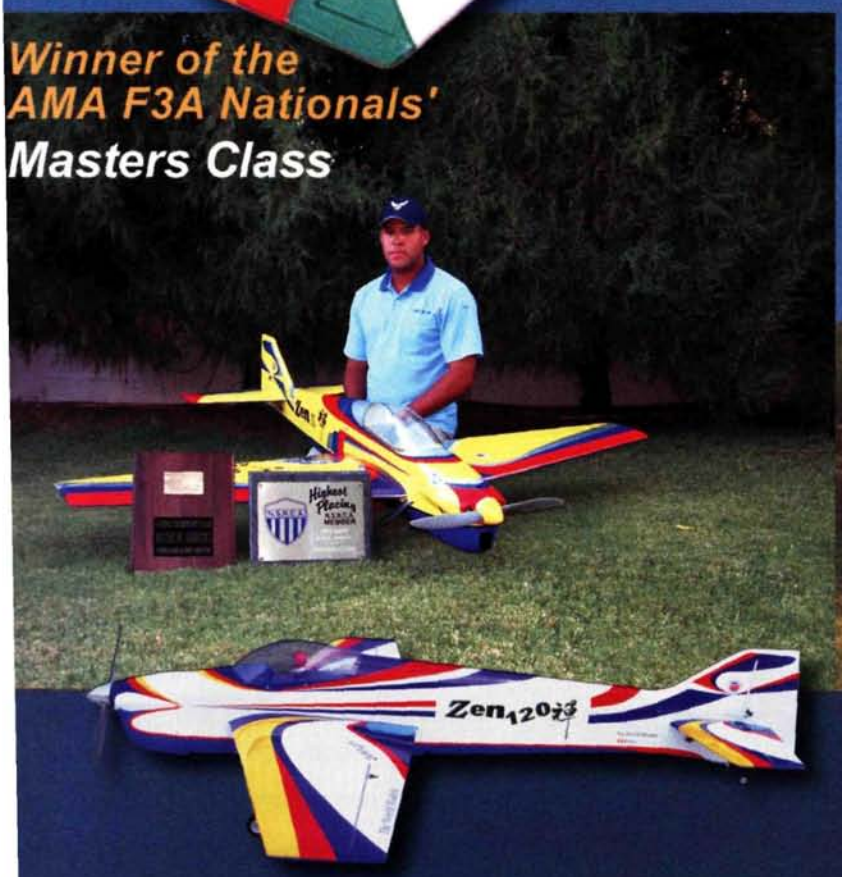
Anti-vibration engine mount and aluminum spinner provided

Latched fiberglass belly pan for housing tune-pipe

Pre-installed retractable landing gears

Pull-pull rudder control

Hand-painted fiberglass cowling with 3-D transparent template



by Erick Royer

It seems as though every week, I meet someone at the field who's interested in getting involved in RC flying, and his first question is always "What's the best plane for me to start with?" In my opinion, the best trainer you can buy is one that you can assemble quickly, requires very little skill to set up and is capable of growing with you as your flying skills develop.

The Megatech Nitro Capitol Flyer is the first trainer I've seen that fits that bill. It can be assembled in less than 1 hour using four common tools: needle-nose pliers, standard and Phillips-head screwdrivers and an adjustable wrench. The plane comes with two dihedral braces—one with 6 degrees of dihedral for trainer mode and one with zero dihedral for aerobatic mode.

PHOTOS BY JOHN REID & RICK BELL

MEGATECH Capitol Flyer

Quick-building .40-size trainer

KIT CONTENTS

The Nitro Capitol Flyer comes with the wing halves, the horizontal stabilizer/elevator, the vertical fin/rudder and the fuselage completly covered. A universal engine mount is already installed, as are the fuel tank and the fuel lines. The landing gear comes with the wheels installed. The nosewheel is mounted on the firewall with the pushrods in place. All pushrods have been assembled and adjusted to the correct lengths. Two wing braces are included—one with dihedral and one without. The kit even includes the spinner.

ASSEMBLY

This is by far one of the easiest planes to assemble that I have ever seen (it's nearly as easy as a true ready-to-fly). The photo-illustrated manual is divided into 11 easy steps.

Engine installation. The aluminum engine mount is universal and has been installed in the Capitol Flyer's nose; it uses a bar-clamp system that doesn't require you to drill any holes. It should be able to accommodate any engine in the .40 to .50 range without a problem.

I used a Megatech .46 2-stroke engine. I simply placed the engine on the mount and attached the two metal clamping plates to both sides of the engine flange with the supplied nuts and bolts. The bottoms of the mounting rails have hex cutouts to secure the nuts, so you don't have to use a wrench. As I tightened the clamps, I was careful to torque the bolts gradually and did not tighten only one while leaving the others loose; in fact, I suggest that you snug them down as you would the lugs on a wheel—in a crisscross pattern. If you have some blue thread-locking compound, it's a good idea to use it on the nuts to make sure that they don't loosen in flight because of engine vibration. If you don't use thread-locker, be certain to check these bolts periodically.

After installing the engine, I installed the muffler and then connected the fuel lines. Two fuel lines are supplied and are already attached to the fuel tank. I simply connected the right-hand line (supply) to the carburetor and the left-hand line (vent) to the muffler's pressure nipple. Be sure to push these lines all the way on.

Radio installation. I chose to install the radio before I installed the landing gear. This allowed me to lay the fuselage flat on my worktable with the nosewheel hanging over the table's edge. On the installed servo tray are three openings: two at the rear for the elevator and rudder/nosewheel servos and one at the front for the throttle servo. I installed three Futaba 3003 servos in their respective openings and secured them with the mounting screws that come with them. I installed the two rear servos with the output arms facing the rear of the airplane and the throttle servo with the output arm facing the left side of the fuselage (when viewed from the front.)

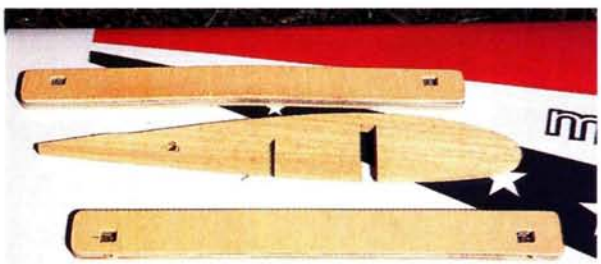
Then, I removed the output arms from each servo and temporarily connected the receiver and battery to the system. I turned on my radio and centered all the trims. I then reattached the servo arms and tried various spline positions until I found one that centered the arm. I secured the servo arms with the supplied screws and attached the correct pushrod clevises to every servo.

I wrapped the receiver with foam and installed it just behind the servo tray. Using double-sided tape, I installed the battery in front of the servo tray. I installed the receiver switch in the hole in the right side of the fuselage.

Tail assembly. Attach the tail surfaces by placing the horizontal stabilizer in the slot in the fuselage; then, slide the two long bolts attached to the vertical-fin assembly through the holes in the fuselage and stab. Secure these bolts using two washers and two wing nuts. I also used a drop of blue thread-locker on them to prevent them from coming loose.

I finished the tail section by attaching the elevator and rudder pushrods. Since the servos were centered in the previous setup, I took the time to adjust the clevises to ensure that the elevator and rudder were mechanically centered. I was pleased to find that they were only one to two turns away from being perfect. Any other adjustments that might be needed in flight can be made with the radio trims. I was careful to install the safety-keeper tubing over each clevis to prevent them from coming off in flight.

Landing-gear assembly. To install the landing gear, I had to find the three holes in the bottom



Unique to the Capitol Flyer is that its wing's dihedral angle can be altered. Do this by changing the dihedral brace and the root rib. The V-shaped brace provides more stability, and the straight brace is for aerobatics.

The tail feathers are simply bolted into place with two bolts that are attached to the vertical fin.

SPECIFICATIONS

MODEL: Nitro Capitol Flyer

MANUFACTURER: Megatech Intl.

TYPE: semisymmetrical-wing trainer

WINGSPAN: 62 in.

LENGTH: 47 in.

WEIGHT: 6 lb., 2 oz.

WING LOADING: 17 to 20 oz./sq. ft.

RADIO REQ'D: 4-channel w/4 standard servos (elevator, rudder, throttle and ailerons)

RADIO USED: Futaba Skysport/4 Futaba 3001 servos

ENGINE REQ'D: .40 to .50 2-stroke

ENGINE USED: Megatech .46 2-stroke

PROP USED: 11x6 APC

FUEL USED: Wildcat 15%

PRICE: $129

FEATURES: all-balsa and plywood construction; nose gear and linkages mounted and adjusted; all hinges glued and pinned; all servo and switch cutouts are drilled; universal engine mount for .40 to .50 2-stroke engines; throttle linkage installed and cut to length; main landing gear attached with only three wing nuts; very stable and easy to fly; semisymmetrical aerobatic airfoil.

COMMENTS: instructors and students will enjoy flying this plane. It's designed to grow with you as your skills increase. The easy assembly will get you to the field and into the air fast!

HITS

- Fast, easy assembly; wing nuts used as fasteners (no tools required).
- Nice flight performance.
- Nice covering job.
- Two dihedral options (zero and 6 degrees).

MISSES

- None.

FLIGHT PERFORMANCE

Teaching someone to fly with the Nitro Capitol Flyer is a real joy and a lot of fun. The plane is so solid that you can spend more time teaching than worrying about saving the plane. On the day I test-flew it, there was a moderate 5 to 10mph breeze and the plane handled it effortlessly.

TAKEOFF AND LANDING

As I taxied out on the runway, I was surprised by the nosewheel steering's responsiveness. Applying too much rudder will cause the plane to veer and a wingtip to touch the ground—not a major problem, as the plane tracks straight when power is applied and requires only slight rudder corrections. I lined the plane up with the runway centerline and slowly advanced the throttle. The Megatech .46 is a strong engine, and with a touch of up-elevator, the plane didn't take more than 40 feet to break ground. Climb-out is rock solid, and the wings didn't rock excessively, even in the breeze. When it reached about 100 feet, I banked it toward the runway, and as soon as I released the ailerons, it immediately banked itself. It required a couple of clicks of down-elevator to keep it flying "hands-off." I ran a few low passes down the runway centerline to see how well it tracked close to the ground, and then I set up for my first landing. On the downwind leg, I reduced the throttle to ⅓, and the Capitol Flyer gradually lost altitude. I was careful not to use excessive elevator to keep it flying level, as I did not want to bleed off all airspeed. As it turned onto final, I reduced the throttle to ⅛, and it maintained a nice glide path. When it reached the runway, I began to slowly feed up-elevator, and I reduced the throttle to idle; the plane settled into a very nice, soft landing on the main gear.

LOW-SPEED PERFORMANCE

Even with its aerobatic wing brace installed, the Capitol Flyer still has many trainer qualities, including the ability to fly slow and steady. It handles very well, and the controls remain very effective at low speeds. When the plane does stall, the right wing drops slightly as the nose falls. A few clicks of power are all that are required to get it flying again.

HIGH-SPEED PERFORMANCE

I wouldn't consider the Nitro Capitol Flyer a speed demon, but it does groove along nicely at full throttle. Most of the flying is done at between ½ and ¾ throttle, though. The Megatech .46 is a great little engine, and it performed very well when I switched the wing to the zero-dihedral brace and flew some aerobatics.

AEROBATICS

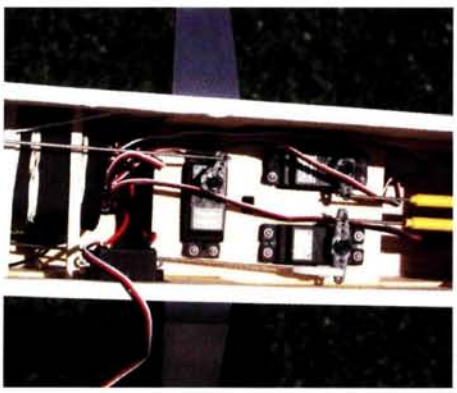
Even in trainer mode with the dihedral brace, the plane was able to perform loops and rolls. During rolls, it tended to lose altitude during the inverted portion, but that was easily corrected by applying down-elevator. When I switched to the aerobatic-mode with the zero-degree brace, I noticed much snappier performance. Rolls were more axial, and point rolls were also easy to do. The wing's semisymmetrical design, coupled with this wing brace, lends itself to excellent inverted-flight performance. Only a little down-elevator was needed to sustain inverted flight. Figure-8s, Cuban-8s, split-S's and even snap rolls were all impressive.

of the fuselage through the covering. After I had found them, I used a sharp hobby knife to trim away the covering there, and I attached the landing gear with three wing-nut screws—again using blue thread-lock to secure them.

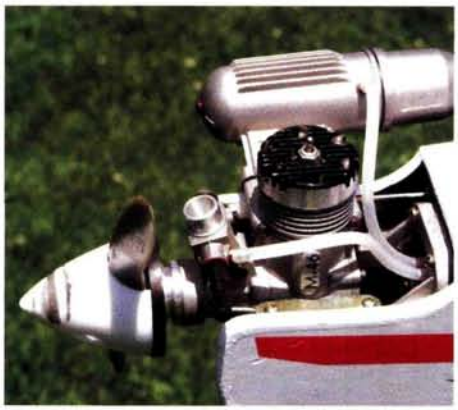
Wing assembly. At the root of each wing panel is a slot for the wing dihedral brace and a hole for the wing-joiner dowel. There are two dihedral braces—one with dihedral for more stable, entry-level flight and one without any dihedral for more advanced flight and aerobatics. I test-fit both before deciding to install the one with dihedral for the test flights. The wing halves go together without glue. I slid the wing brace into the slot in one wing half and secured it with a wing-nut bolt. Next, I slid the other wing half over the brace and attached it with the other wing-nut bolt. You have a very sturdy wing when you've done this.

Next, I installed another Futaba 3003 servo for the ailerons in an opening on the wing. I connected the servo to the radio system to ensure that the servo post was at its neutral position, and then I attached a servo control arm. I connected the two assembled pushrods to the servo and then to the torque rods. I secured the clevises with safety-keeper tubing.

I installed the wing on the fuselage and checked the center of gravity (CG). I installed the wing with the 10 supplied rubber bands. To check the CG, I used my Great Planes CG Machine and set it to the recommended 3.5 inches back from the wing's leading edge. If you don't have a CG Machine, you can also make a mark 3.5 inches back from the leading edge on the underside of the wing and suspend the plane with one finger on each mark to see how the plane balances. I was happy to see that the CG matched the manufacturer's specs. If your plane is tail- or nose-heavy, you may move the receiver's battery forward or backward, respectively.



The servo tray comes installed and provides a logical layout for the servos.



The aluminum mount secures the engine with a bar clamp. No drilling required here!

Everything looks great! The best part is that it took less than 1 hour to assemble.

CONCLUSION

Megatech has a sure winner with the Nitro Capitol Flyer. It's fast and easy to assemble, and it's constructed of high-quality materials. The semisymmetrical wing, coupled with the two wing braces, gives you a plane with excellent trainer characteristics that can easily be converted into a high-performance aerobatic aircraft. If you want a trainer that's very stable and capable of growing with you as your skills improve, the Nitro Capitol Flyer is the plane for you.

APC Props; distributed by Landing Products (530) 661-0399; apcprop.com.

Futaba Corp. of America; *distributed by Great Planes; futaba-rc.com.*

Global Hobby Distributors *(714) 963-0329; globalhobby.com.*

Great Planes Model Mfg. Co.; *distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; greatplanes.com.*

Magnum; *distributed by Global Hobby.*

Megatech Intl. *(201) 662-2800; megatech.com.*

by Rodney Roy

Introduced in 1998, Thunder Tiger's Raptor was an instant success. After many thousands of flight hours were accumulated by novice and 3D pilots, it was found that some of the heli's areas could be improved. Thunder Tiger listened to its customers' feedback and incorporated many of their suggestions—turning a good helicopter into a great helicopter. In September 2002, Thunder Tiger released the Raptor V2, and it has taken the heli market by storm. If you liked the way your old Raptor performed, then you'll love the V2.

PHOTOS BY RODNEY ROY & JOHN REID

Because I broke in the engine on a test stand, there weren't any surprises at the field during the first hovering flights. The Thunder Tiger PRO-39H ran like a clock. I set up the heli using the figures given in the manual because most modelers would use these as a starting point.

GENERAL FLIGHT CHARACTERISTICS

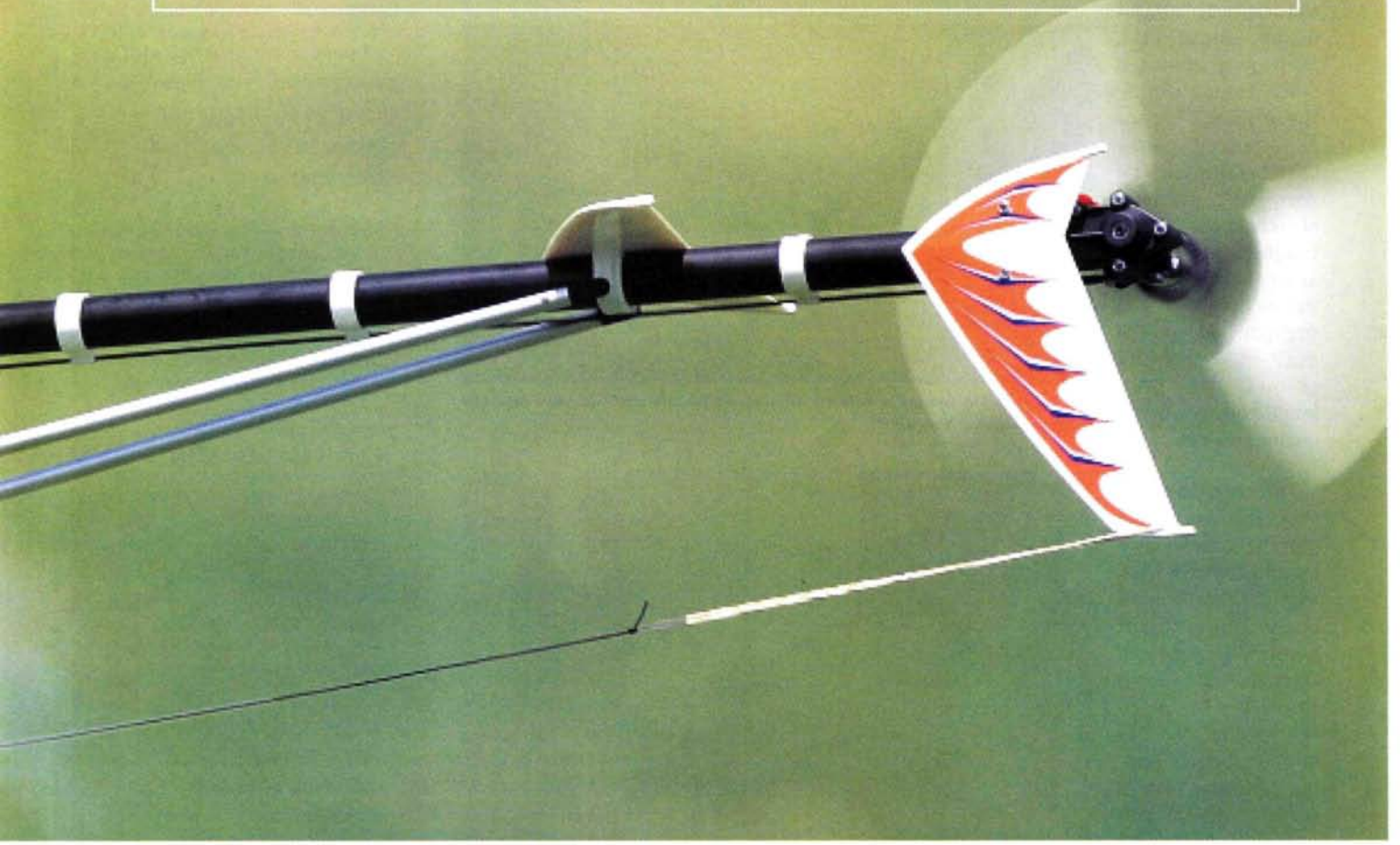
First liftoff was quite a surprise—no shaking or vibrations anywhere on the heli. Everything was smooth; even the fuel in the tank was rock-steady. No trim changes were needed on the cyclic controls, and the tail-rotor trim was perfect. The main rotor-blade tracking was off a little, and a ½ turn on a ball link quickly had the blades in track. Control response was very solid and precise without being twitchy or overly sensitive. Because I used the stated 6 degrees of hovering pitch at center stick, I had to adjust the throttle curve slightly to hover at this setting. It felt great at a head speed of about 1,500rpm.

After a few tanks had been run through it, I flew some circuits and found that the control response was nicely balanced.

AEROBATICS

When compared with other helicopters, the Raptor really stands out as a star. I first completed some basic aerobatics and proceeded to put it through its paces. Loops and rolls were easily done and very smooth. The tail rotor has plenty of authority; pirouettes and 540 stall turns were quick and precise. The heli responded as I felt that it would—flawlessly. Inverted flight was OK; however, a better throttle and pitch curve would make it perfect. Mild 3D aerobatics were also possible with the recommended settings. I performed flips, tumbles and other mild 3D maneuvers and found that I needed to add cyclic to throttle mixing to keep the head speed up during these. I was amazed at how well the stock wooden rotor blades performed.

I then tried some autorotations with the kit blades, which were nonevents, though it's best to do them when there is some wind, as there isn't much energy left in the blades at the bottom of the autorotation. The Raptor is an amazing helicopter for pilots of all levels.

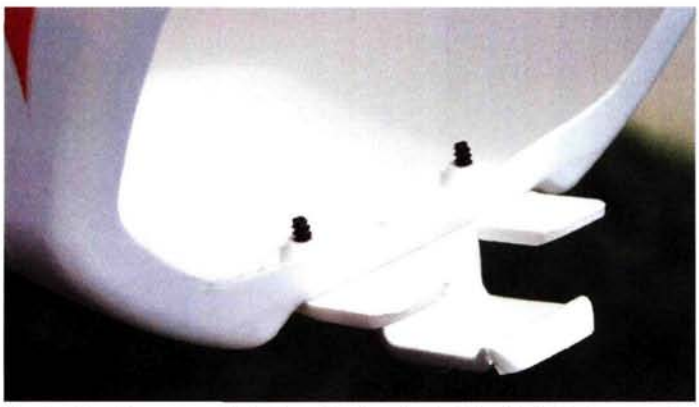


The best just got better!

THUNDER TIGER Raptor 30 V2

NEW FEATURES

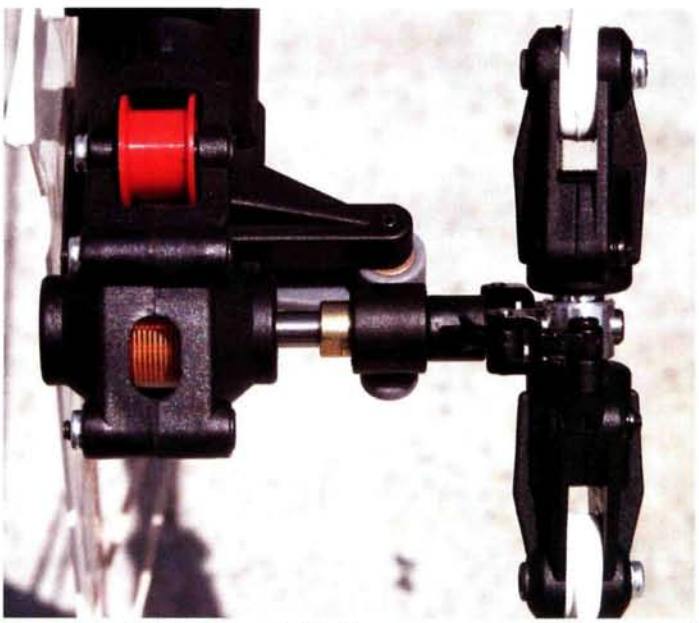
Thunder Tiger made 17 major improvements to the Raptor to enhance its durability and flight performance. Some of the changes are subtle, while others are more obvious. The most noticeable change is the slimmer and sleeker canopy. It also has an air inlet on each side to direct cooling air toward the fan air intake. Some of the other improvements include a beefier collective-pitch-control arm to handle the rigors of aggressive 3D maneuvers. The larger blade axle, radial and thrust bearings in the rotor head allow smoother and more precise blade-pitch commands. One area I'm glad to see improved is the engine clutch; the original Raptor experienced some clutch failures. The new, larger-diameter clutch is made of a tougher spring-steel alloy. The main frames have also been strengthened, and the built-in cooling shroud has been lengthened for better engine cooling.



The front of the canopy is held on the chassis by this clip that slips over the front skid brace. Very slick!

KIT CONTENTS

The Raptor 30 V2 base heli comes as a kit and contains bearings (29 total) on all of its major pivot points. An upgrade of 20 additional bearings for even more precision is available. The 48-page, nicely laid-out instruction manual contains information on safety warnings, items and tools needed to complete the kit, assembly, maintenance and flight training. Like numerous other heli manuals, the Raptor's has many exploded, isometric drawings and few written assembly instructions. This isn't a problem for those who have built a heli or two, but it can be a little confusing for the first-time builder. Fortunately, the Raptor builds easily and quickly, and a careful study of the drawings will ensure success. If you don't feel up to the task of building a heli, the Raptor is also available as an ARF that's completely built with a Thunder Tiger PRO-39H engine and muffler installed.



The tail rotor is belt-driven and virtually maintenance-free. The oversize tail-blade grips are from the Raptor 60. Note the idler pulley; it prevents the belt from slipping on the toothed pulley.

ASSEMBLY

Frame assembly. I cleaned off my workbench, reviewed the manual a couple of times and gathered the tools I needed to assemble the kit. I had heard a lot of good things about this helicopter and was eager to find out whether all of the hype was true. To power my Raptor, I used Thunder Tiger's PRO-39H engine and Wildcat 30-percent-nitro heli fuel. For this review, instead of a blow-by-blow "screw part A to part B," I'll touch only on those areas that need some clarification.

First is the fuel tank. Mine came assembled with the fuel pick-up line and clunk installed. Most kit-supplied fuel lines won't stand up to 30-percent nitro for very long, so I changed the line in the tank to a more durable one. The clutch bell comes with the liner glued into place and the bearings installed. When you install the pinion gear, be sure to use a thread-locking compound on the threads and securely tighten the gear to the clutch bell.

Two things to look out for during frame assembly: first, when you install the main shaft bearings, use the main shaft to ensure that the bearings are properly aligned. Keep the shaft in place until the frame halves are secured tightly together. Second, be sure to install the thrust washer on the start shaft before you slide the shaft into the clutch bell; it's easily missed. Also, when you assemble the main drive gear, make sure that you install the autorotation sleeve with the hole to the underside of the gear assembly.

SPECIFICATIONS

MODEL: Raptor 30 V2

MANUFACTURER: Thunder Tiger

DISTRIBUTED BY: Ace Hobby Distributors

TYPE: 30-size helicopter

ROTOR DIAMETER: 49 in.

LENGTH: 43.5 in.

HEIGHT: 15.7 in.

WEIGHT: 6.25 lb.

RADIO REQ'D: 5-channel heli radio w/5 servos

RADIO USED: JR 8130 transmitter w/4 JR NES 4131 servos and 1 JR DS8417 digital servo on tail rotor; JR G410T gyro

ENGINE REQ'D: .32 to .39 2-stroke heli

ENGINE USED: Thunder Tiger PRO-39H

FUEL USED: Wildcat 30% heli

PRICE: $264.95

FEATURES: redesigned main frames; longer built-in cooling shroud; sleeker canopy; stronger collective-pitch arm; finished main rotor blades; bearings on the major pivot points; belt-driven tail rotor; larger, stronger clutch and clutch bell; ball links on all pushrods; colorful decals; informative instruction manual.

COMMENTS: the Thunder Tiger Raptor 30 V2 is a great-performing helicopter for beginners and experts. I really like the fact that it's so easy to build; it took me about three days from the time I opened the box. The Raptor's flight characteristics can best be described as refined; it's solid, predictable and has no bad habits. Because of its low cost, it makes a great aerobatic trainer with which to learn new maneuvers. I highly recommend the Raptor for all heli pilots.

HITS

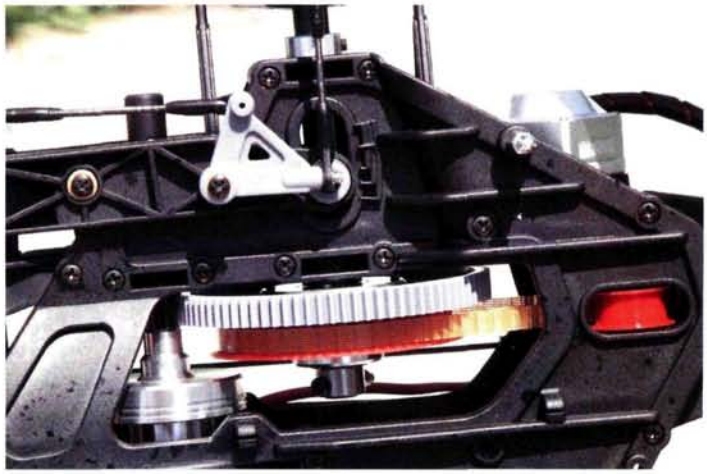
- Easy to build.
- Great setup instructions.
- 3D capabilities.
- Low cost.
- Fun to fly!

MISSES

- Could use more written assembly instructions.

The collective-pitch-control arm contains lots of parts and is easy to build. The linkage balls that are screwed to the elevator-control lever can be easily overlooked. Two balls are installed on a single screw, and it's hard to see this in the drawings.

Before I installed the engine, I ran a few tanks of fuel through it on a test stand to break it in. This is always a good practice as you can closely set the needles for a reliable engine run. One point the manual doesn't cover is balancing the cooling fan and checking it, and the clutch, for runout. Because both these components run at engine speed, a lot of damaging vibration can be produced. I also added a remote glow igniter as the engine head faces forward, and it's difficult to reach.

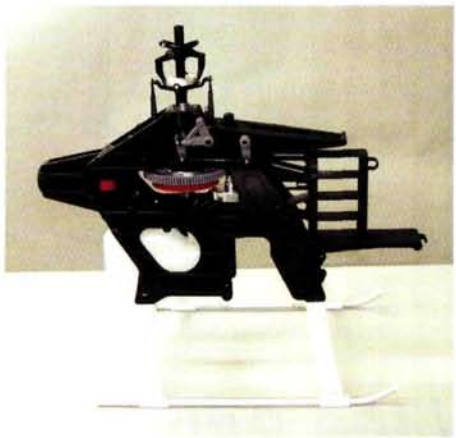


Here's the drive system; it's very smooth in operation. The raised lines behind the bellcrank are the molded-in "pitch-scale" marks to set up the collective pitch.

Main rotor. The Raptor's main rotor is a beauty; it builds easily and is silky smooth in operation. The exploded drawing does a great job of showing the order of assembly. A couple of things, though: before you slide the blade axle through the dampers, apply a light coat of silicone grease to the axle. This will make it easier to install. Before you attach the blade grips, slide the hoop-shape control rods on the main rotor hub. If you don't, you'll have to disassemble the grips to get the hoops in place. A nice addition are the thrust bearings, but the instructions don't mention that they should be greased before they are installed.

Tail rotor. The tail-rotor unit uses blade grips and bearings from its larger brother, the Raptor 60. This increase in size provides more solid control, longer life and a larger-diameter tail rotor. Assembly is straightforward and problem-free. A few things to watch out for: when you assemble the hub to the output shaft, be sure to engage the long setscrews into the dimples in the shaft, and use thread-lock on the setscrews. Clamp the blade grips into place after you've installed the bearings on the hub—not before. After the pitch slider has been assembled, check it for smooth operation: there shouldn't be any binding. When you install the tailboom, be sure to twist the drive belt the right way so the tail rotor spins in the correct direction. The drive belt in my Raptor turns effortlessly when it is spun by hand.

Radio installation and setup. For the radio system, I used a JR 8103 transmitter and JR NES 4131 servos for all the controls, but on the tail rotor I used a JR DS8417 digital servo. To tame the tail, I decided to use a JR G410T gyro. Following the instructions, I installed the components (pretty straightforward); the manual even tells you which servo arms to use for different radio manufacturers. For more precise control, all of the pushrods use ball links and not Z-bends. I installed the gyro on the shelf behind the main shaft. The lead for the gyro runs along the frame, and molded-in clips retain it. One area of concern to me is the tail-rotor pushrod. It's a wire that's in two pieces that are joined by an aluminum coupler. I recommend that you file a flat spot on the two rods so the setscrews can get a better bite, and use thread-lock on the setscrews.



The frames are self-aligning and assemble quickly. The engine is installed from the bottom and just slides into place.

The main rotor may look complicated, but it actually goes together easily. Note the overhead flybar.

Thunder Tiger did a good job with the initial radio-setup instructions: the simple directions and clear drawings are easy to understand. Thunder Tiger also cleverly molded in a "pitch scale" on the left side frame and a pointer on the collective pitch lever. There are three scales: for beginner, intermediate and expert pilots. When you use the pushrod lengths stated in the manual and adjust your radio accordingly, your pitch curves will be very close to your proficiency level's.

Final assembly. I trimmed the excess plastic from the canopy and then washed it in hot, soapy water. With Lexan scissors, I trimmed the smoked windshield to its scribe lines. After I had carefully trimmed the decals from the sheet, I sprayed the canopy with window cleaner and applied the decals; the window cleaner allows them to be floated into place. After they were in place, I squeezed out the excess window cleaner with a soft towel. Because of the canopy's compound curves, some of the decals didn't adhere. To remedy this, I carefully used a heat gun to make them conform to the curves; just a little heat did the trick.

The main rotor blades are finished and almost ready to use. Epoxy the root reinforcements into place after you remove the blade covering underneath them. When I put the blades on my balancer, they were right on the money! Not bad for wooden blades. I then checked over the entire heli, and it was ready to go!

FINAL THOUGHTS

The Thunder Tiger Raptor 30 V2 is a very high-quality helicopter at a reasonable price. Assembly was quick and easy because the parts fit perfectly. In fact, even if you've never built a helicopter, you could successfully build the Raptor inside a week. Though the manual could use more written instructions, the excellent drawings and thorough setup information go a long way to compensate for this. With its great flight performance, the Raptor 30 V2 is definitely a keeper. ✈

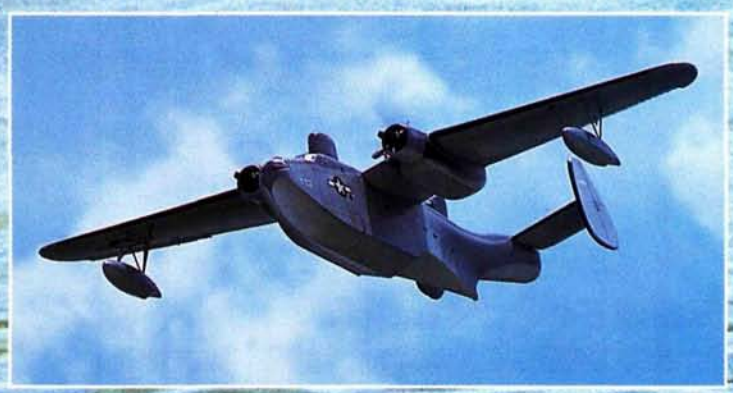
JR; distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

Thunder Tiger; distributed by Ace Hobby Distributors Inc. (800) 322-7121; acehobby.com.

Wildcat Fuels (859) 885-5619; orders only (888) 815-7575; wildcatfuel.com.

Martin PBM

by Keith Sparks



WINGS OF WAR

When I started this project, I wanted to design something different and dependable that could fly off water. I had noticed that flying boats handle better than other floatplanes; rough "seas" and crosswinds wreak havoc on the little pontoon planes. Enter the Martin PBM Mariner. The full-size flying boat hunted submarines in the North Atlantic as well as in the Pacific, so I felt sure that a model of it could certainly handle the lakes in Texas!

This design has it all when it comes to "different": graceful gull wings, an unusual tail group and a deep-vee hull design. As for dependability, I've flown this model more than 50 times and have had to use the rescue boat only once. Folks have asked me, "Whose kit is it?" and "Where did you get the plan?" When I told them it was my own, some accused me of hoarding a fantastic design. I wanted to prove them wrong, so here it is ... your next flying boat.

FUSELAGE

You will notice that I use the word "sand" a lot. Don't worry; 80 percent of it is done on blue foam, so it's fast and easy. Fuselage section half-patterns are on the plans; to make a whole section pattern, you'll need to fold card stock in half, and then glue the half pattern to the card with the fold as the centerline. Cut the pattern from the folded card, and both sides will be the same shape.

To begin fuselage construction, trace the

A twin-engine WW II-era long-range patrol bomber

Mariner

PHOTOS BY DEBRA CLEGHORN & KEVIN SPARKS

patterns with a felt-tip pen on 2-inch-thick blue foam; transfer both centerlines so that you can properly align each section. Because the tail rises above the side-view centerline, on those pieces, you'll need to mark three lines to help with alignment; sections 28, 29 and 30 have dual centerlines. I used my scroll saw to cut the sections and then transferred lines to the sides of each section with a square block. Note: cut slightly outside the lines and make sure that the saw blade is square. Work on a sheet of foam rubber to protect the blue foam from hard objects on the work surface.

Bonding. Use four drops of epoxy to hold the sections together; keep the drops at least 2 inches from the outer edges. Bonding four sections at a time, start with section 16 and work your way to no. 1. Use weights for clamping pressure; as the epoxy cures, check the alignment marks frequently. Bond sections 17 through 27, and then sections 28 through 38. Finally, bond the three built-up section groups together, and secure them with masking tape (stretch the tape a little as you apply it so it will pull the pieces tightly together). I made a stand out of scrap foam to rest the fuselage on.

Shaping. To hold the sections together while you sand, put masking tape on the sides that you aren't sanding. If an epoxy bond breaks, just add a few more drops of epoxy and use the pen marks or sanding scratches for realignment.

Sand the flat spots using 60-grit sandpaper and work your way to the nose. Sand until the pen marks are nearly gone. Poke the pen into the foam about every fourth section so that you won't completely sand away the centerline references. When the original lines are gone, mark new ones before you continue to a new area. I made a sanding block of scrap foam to sand the concave surfaces of sections 17 through 29. The sandpaper must overhang the block to prevent its corners from gouging the foam. Cutting a radius at the corners of the paper helps, too.

While sanding the corners off the sections, I found it easier to use the sanding block as if it were a sled going down a flight of stairs. The exception was along the top of sections 22 to 29; I had to sand across the fuselage until the "steps" were gone.

I also used a cotton glove and a sheet of sandpaper folded in half with its sides glued together. I needed the glove for traction; otherwise, the paper would grip the foam and my hand would slide over the paper. At this point, the fuselage needed the canopy and ball turrets fitted. Test-fitting as I went along was the best way to go. You can omit these parts and paint them on later.

After going over the fuselage once more with 120-grit sandpaper, re-mark the reference lines and number the sections. Next, separate the sections at the following joints: 3-4, 6-7, 11-17, 28-29, 34-35 and 37-38. To separate the stubborn bonds, pull a fine wire through the gap between the sections to break the bonds. I used a hot wire to cut out the cores of the sections after I had made wire guides for the sections listed above. An alternative method would be to cut out the cores with a scroll saw. Try to keep the wall at least ¾ inch thick and be sure to maintain this distance where the sections taper.

Bond the sections together again with a light coat of epoxy on the inner half of the sections (you don't want the glue to ooze onto the outside of the fuselage). Cut the lite-ply bulkheads ⅛ inch smaller than the fuselage sections on the outside edge. Fill the ⅛-inch void around the bulkheads with the softest balsa you can find, then sand these areas flush. I used the "sanding glove" with 180-grit sandpaper to remove any defects.

Glassing. To apply fiberglass cloth to foam, thin Zap finishing resin with denatured alcohol by 25 percent. Lay the cloth on the foam and blow away the wrinkles with your breath; this allows the cloth to lie naturally. Then use an inexpensive brush to apply the resin to the cloth. Watch for dry spots at the joints; resin will wick into the joints, so you'll need to add a little more in those areas.

Start glassing the fuselage on the bottom with one layer of ¾-ounce glass cloth. After it has set up, trim the edges with a razor. Glass the top of the fuselage with ½-ounce cloth, and trim the edges the same way as you did the bottom.

Make a ½-inch-square sanding block out of hardwood stock and sand a V-groove into the keel. Use epoxy to bond ½-inch-square hard balsa into the groove. I used masking tape to protect the hull when I sanded the hard balsa to shape. Add another layer of ½-ounce cloth to the hull.

SPECIFICATIONS

MODEL: Martin PBM Mariner

TYPE: twin-engine sport-scale floatplane

WINGSPAN: 78 in.

LENGTH: 75 in.

WING AREA: 1,177 sq. in

WEIGHT: 16 lb.

WING LOADING: 31.3 oz./sq. ft.

ENGINES REQ'D: two .52 4-strokes or two .40 2-strokes

RADIO REQ'D: 4-channel (rudder, elevator, throttle, ailerons)

The author prepares one of his PBMs for a patrol flight at a local lake.

To make the chines, tape a waxed sheet of plastic to the sides of the fuselage, and trim it to extend ¼ inch beyond the bottom of the hull sides to form a "dam." Then apply masking tape to the hull ½ inch from the edge. Make an angled squeegee out of plastic, and use it to apply automotive-body filler to the space between the dam and the tape. This forms the sharp chines along the hull sides. Note: automotive-body filler will melt foam. Before you apply it, make sure that the glass cloth is glossy with resin because it is the barrier between the filler and the foam.

Sand the chines flush with the fuselage sides, and add another layer of ½-ounce cloth to the fuselage top and ¾-ounce cloth to the bottom. Install the cockpit and gun details and the turrets that cover them.

Hatch. Use a hacksaw blade to cut the fuselage open and make a hatch opening just below the cockpit for access to the radio gear. Then sand the mating surfaces smooth and bond 1/16-inch-thick balsa to the fuselage. Working slowly and test-fitting often, sand away ⅛ inch from the hatch cover to make space for the balsa sheets, then bond 1/16-inch balsa to the hatch cover. With the hatch installed, sand the balsa flush with the outside of the fuselage. Note: this step should be considered a practice for the stab and wing installations. They will be done in much in the same way.

TAIL SURFACES

The tail section is made of ¾-inch foam sanded to ⅝ inch. Start the tail group by bonding a ¾-inch piece of 1/64-inch plywood to the top and bottom of the ½x⅝-inch balsa trailing edge. Use epoxy to bond them to the ⅝-inch foam sheets to form the fins and horizontal stabilizer. Sand the blue foam flush with the plywood, and use a router to cut a groove in the stabilizer to accept the rudder torque rods. Cut the horizontal stabilizer into two pieces at a 14-degree angle and glue it back to form the 28-degree "V" that the PBM was famous for. Assemble the torque rods and install them in the stab. Epoxy the balsa fill strips to hold them in place, and sand them flush with the stabilizer. Note: apply a lot of wax to the torque rods to protect them from any epoxy that might touch them during assembly.

Sand the fins to shape, and use a router to cut the groove for the horizontal stabilizer. Cover the fin and stab with two layers of ½-ounce cloth; overlap the layers at the leading edge for dent protection. Note: use coat hangers to hold the tail parts while you apply the cloth. Assemble the control surfaces as shown in the plans and fit them to the fin and stab. Cover the movable surfaces with Solartex, and set the assembly aside until later.

Place the fuselage on a flat, level surface, resting on its keel. Block up the chines the same distance, and use a weight to keep it all in place. The hull is now at zero degrees; all angles are made from this reference. Make a line at the tail 2 inches above the tail section centerline and parallel with the work surface; this is the stab saddle location. Use a hacksaw blade to remove the fuselage section above the line to form the stabilizer mount. Sanding away a little at a time, make a saddle for the stab to sit in. Attach the push/pull rods and rod supports to the tail group. Then feed them into the fuselage and bond the stab into place. Replace the fuselage section over the stab and epoxy it into place.

THE WING

Start the wing by assembling the spar assembly. Use a long straightedge continually to keep the top of the outboard wing panel spars parallel. A 1/64-inch shim must be added

to the center-section spar to ease installation of the outer wing panels. The wing cores are cut out of white foam with a hot wire, and then the gull-wing angles are cut.

Remove ½ inch of the foam from the wing center-section core, 4 inches from the leading edge and at 90 degrees to the chord line. Use the center section leading-edge core as a pattern to mark the spar slot for the outboard panels. I used a scroll saw to cut the slots. Keep the panels in the wing beds while you cut the slots because this helps keep the cuts at 90 degrees to the chord line. Epoxy the leading-edge core to the front of the spar and the trailing-edge core to the back. Use a felt-tip pen to mark the throttle-cable path, and use a Dremel tool to cut a groove in the foam-core that's deep enough to accept the cable tube; install the cable tube.

Use a ¾-inch brass tube with a sharpened circumference as a hole saw to cut the aileron-wire tunnels. To sharpen the tube, use a hobby blade to scrape away its inside edge. As you cut, frequent checks of the cutting angle will help ensure that the tunnel is formed in the correct location.

Sheet the bottom of the wing center section first, and then sheet the top. A slot must be cut in the bottom sheeting so the throttle tube can be held out of the way when you sand the flat section into the leading edge. Epoxy the leading-edge stock into place, and then sand it to blend it into the wing. Cap the ends of the wing center section with 1/32-inch plywood. After the epoxy has cured, sand the plywood flush with the sheeting.

Mating the wing panels. Place the center section on the table (bottom side facing up), with the outboard spars installed. There must be at least a 1/16-inch gap between the spar and the top of the work surface. Temporarily install the outer wing-core panels and make sure that there are gaps at the wing joints and that the joints are aligned properly in relation to the wing center section. The outboard wing panels are sheeted only on the tops. Apply epoxy to the outer panel spar slot and install the spar in the outer wing panel. Before the epoxy cures, attach the outer wing panel to the center section and lay it flat on the work surface as before. Note: a little pressure at the leading and trailing edges (across from the spar slot) will open the slot if additional epoxy is needed.

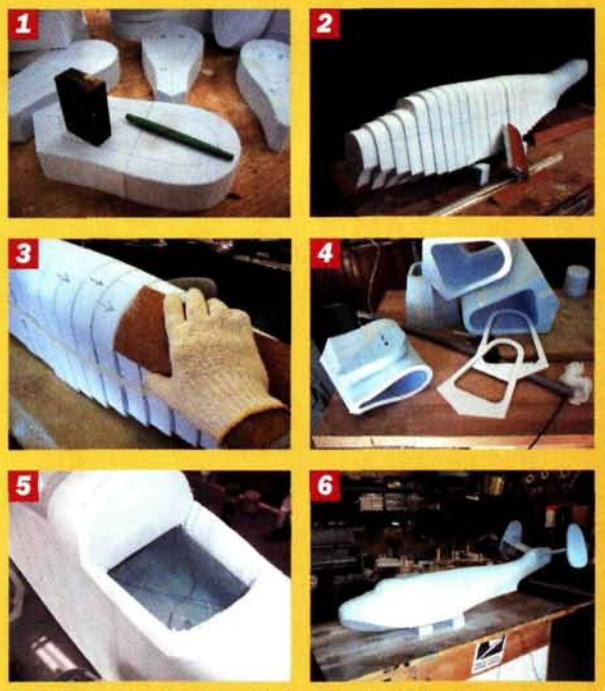
Cut out the servo compartments and the wire "tunnels," as well as the grooves for the control cables. Use 1/64-inch plywood to make the servo-panel's inner surfaces and epoxy them into place. Cut the aileron bays out of the wing and install the aileron cable tubes. Sheet the bottoms of the outer wing panels. Add the trailing-edge balsa to the aileron bays. Build the ailerons from the plans and test-fit them. Cap the wing panel ends with 1/32-inch plywood in the same way as you capped the center-section ends. Epoxy the wingtip cores into place, sand them to shape and then sheet them. Laminate 1/16-inch balsa over the wingtips, and then install the leading-edge stock.

To prevent the outer wing panels from twisting in flight, I use "alignment cones." These are similar to alignment dowels but are molded into place within the end of the wing panels. Make the holes for the cones near the leading and trailing edges of the wing caps. Then remove enough foam from the holes to accommodate the tip of a plastic spinner. Apply a heavy coating of wax to a new spinner, fill the hole with epoxy, and then insert the spinner. Wipe away any epoxy that oozes out. After the epoxy has cured, pop the spinner out. This makes a female mold in the outer wing panel.

Apply a heavy coating of wax to the cone recesses and the areas around them. With the center section standing up on its end, fill the recess with JB Weld epoxy; use just enough for you to see a little extra when viewing it from the edge. Install the outer wing panel, and allow the epoxy to cure before you separate the panels. A little force with a putty knife might be needed to separate them. The mating cone is now permanently bonded to the outer wing panel.

Wing attachment. With the fuselage blocked up on its chines (as you did when you installed the stabilizer), use the wing-root-chord pattern to determine the wing position on the sides of the fuselage. Use the same process as you used for the hatch and the stabilizer to make the saddle for the wing. When you are satisfied with the fit, install the dowel rods and wing-bolt parts. Use masking tape to hold 1/64-inch plywood strips to the wing where it contacts the fuselage. Apply epoxy to the fuselage saddle area and install the wing. After the epoxy has

BUILDING WITH FOAM CROSS-SECTIONS



As described in the main text, the Martin PBM Mariner model is built using a series of blue foam cross-sections that are tack-glued together and then sanded to shape. The roughed-out fuselage is separated into larger sections, and plywood formers are added. The sections are again glued together, and the entire fuselage structure is finished with fiberglass and epoxy resin. For detailed photos of the building process, take the click trip to our website at modelairplanenews.com.

click trip
MODELAIRPLANENEWS.COM
SEE DETAILED CONSTRUCTION PHOTOS

1. Begin construction by cutting out the fuselage station cross-sections. Be sure to mark the horizontal and vertical reference lines on the sides of each piece for proper alignment. 2. Fuselage sections are tack-glued together and ready for shaping. 3. A cotton glove helps you keep a grip on the sandpaper when shaping the foam. 4. I used templates and a hot wire to cut the cores out of the sections, but a scroll saw can also be used to remove the cores. 5. The hatch cut out of the foam. 6. Foam sanded to shape. 7. Primed and ready for paint.

cured, the wing saddle will fit the wing perfectly. Trim away the excess plywood and fill any voids under the plywood. Replace the fuselage section on top of the wing and secure it in place as you did for the hatch.

Nacelles. The nacelles are really two small fuselages, the difference being that sections 48 and 49 are installed after the other sections have been bonded to the wing. To set the engine's thrust angle, place the center section on the table and resting on the nacelles. With the wing at 2 degrees nose up, sand the front of section 49 at 90 degrees to the work surface. Use epoxy to bond the plywood plate to the nacelle. Note: to add support to the engine installation, apply at least 4 to 5 layers of ½-ounce cloth between the plywood plate and the area around the wing.

FINAL DETAILS

Sand the blue foam tip floats and the radome to shape, and then cover them with fiberglass cloth. The radome holds down the hatch and acts as a handle for it. The float struts are made of K&S aluminum and are very strong when assembled as shown. The float angles are set when you make the struts the length shown on the plans.

I installed the servos and receiver high in the fuselage in case water ever enters the fuselage (a little always seems to seep in). I placed clear cellophane tape over the hatch hole after I completed the trim flights. This will keep out what little water tries to enter.

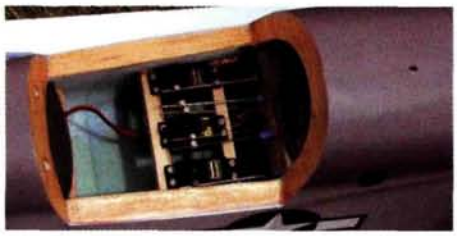
MARTIN PBM MARINER
FSP1103A

Designed by Keith Sparks, the Martin PBM Mariner is a wonderful scale twin-engine flying boat. The fuselage is made by gluing together cross-sections of blue foam and then sanding them to shape, and the wings have foam-cores. The model is covered with fiberglass cloth and resin and sanded smooth. The plans are beautifully drawn and show all the details and the full-size cross-sections for the fuselage.

WS: 78 in.; L: 75 in.; power: two .52 4-strokes or two .40 2-strokes; 3 sheets; LD 3. **$24.95**

Finish. Sand the model to remove any obvious defects and apply a coat of unthinned resin. Use a playing card as a squeegee to apply an even coat (without runs). This step fills in the cloth's weave and provides an absolute barrier between the foam and the primer. Wet-sand the model to remove the surface gloss and apply automotive spot putty, then wet-sand again. Spray on auto primer; any bad spots can be dealt with by using additional spot putty.

Twin O.S. .52 4-stroke engines power the PBM.



The main hatch provides access to the radio gear. To help waterproof the model, place tape over the opening before you secure the hatch cover.

For the final paint job, lighter colors are preferred (more so in the south). Darker colors will cause the skin temperature to rise quickly in the sun, and that can cause the section seams to show. Don't place your model in the sun until the paint has dried completely; to be safe, wait a week.

FLYING

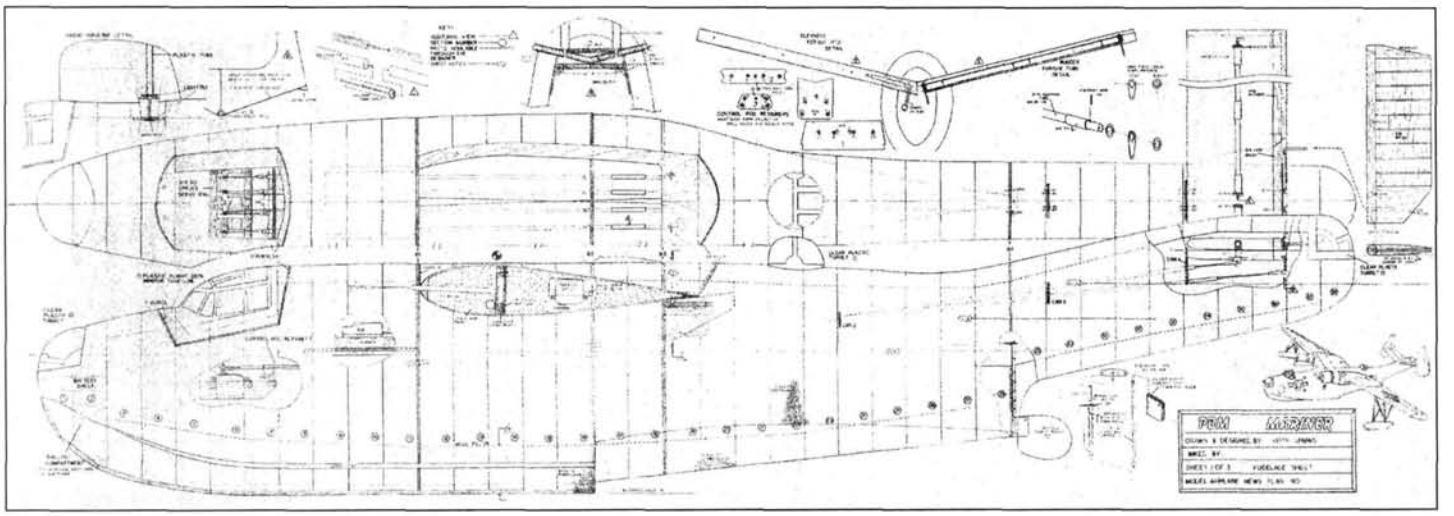
The taxi test went well, but the model had one bad habit: it favored the left float at low speed. A little opposite rudder was required to make the plane go straight when a float was in the water, but a little weight added to the right wingtip fixed the problem.

As the speed increases, hull lift comes into effect, so it's easier to keep the floats out of the water. At ½ throttle, the PBM gets up on step and the water rudder becomes less effective—a welcome surprise—sort of a natural "dual rate." During a test run, one of the wing floats was forced into the water while on step; the float was simply pushed back up by the water, and the wing returned to level. The plane continued as though nothing had happened. Water will hit the props a little just before the model gets up on step, so the hull wake was not a problem.

I wish I could say the first liftoff went without a hitch. The plane jumped off the water like a fighter. I moved the elevator stick to neutral, and the climb became more manageable. With the dual rates on low, the rest of the flight was uneventful. During my first landing, several approaches were required because the PBM would not quit flying; I overshot the intended landing spot several times. After I became used to how slowly this giant can fly, splash-and-goes became my favorite maneuver—the whole point of float flying, in my opinion. Loops and rolls? Why?

There is no kit for this plane, but with a little mail ordering, you can put one together; contact Keith Sparks at Sparky2@att.net or call (817) 233-2650. The Martin PBM Mariner will definitely attract attention whenever you take it out to fly. I hope that you enjoy building and flying your model as much I do mine! ✈

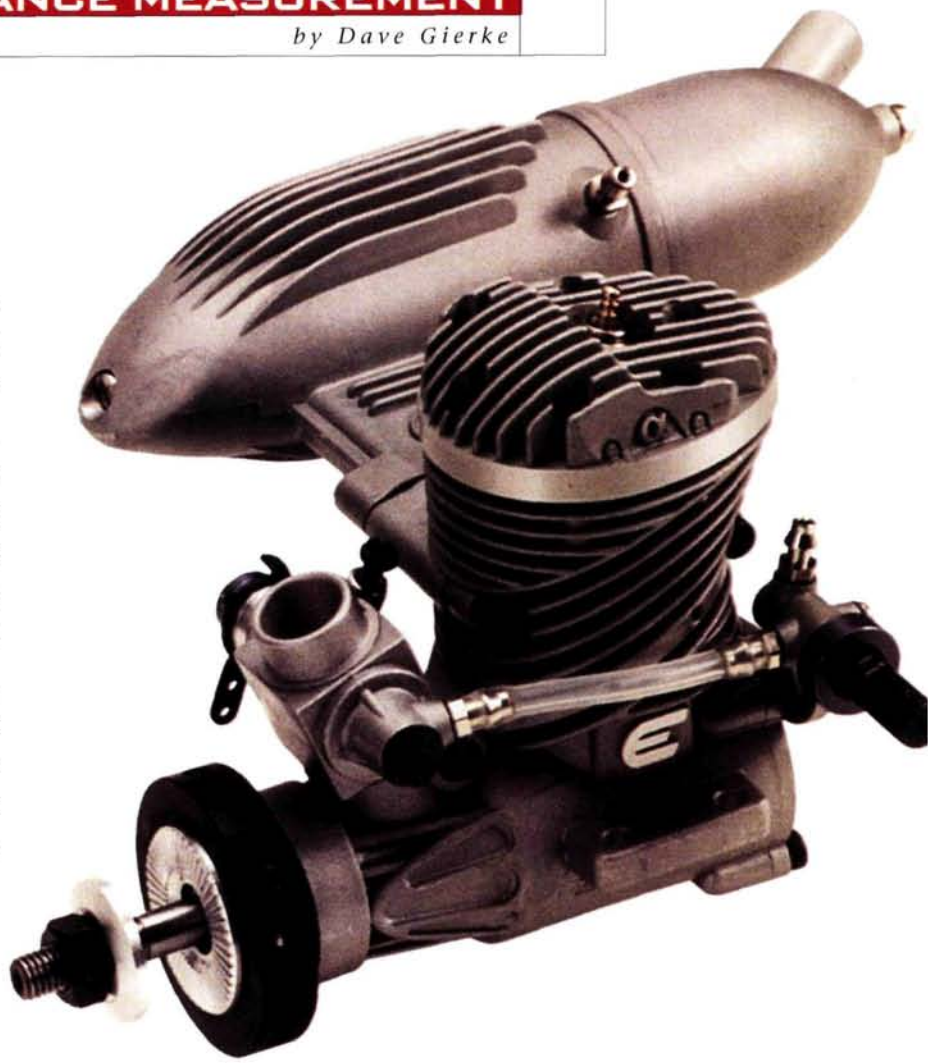
J-B Weld Co. (800) 784-8770; jbweld.net.
K&S Engineering (773) 586-8503; ksmetals.com.
O.S. Engines; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; osengines.com.
Pacer Technology (800) 538-3091; pacertechnology.com.
Solartex; distributed by Global Hobby Distributors (714) 963-0329; globalhobby.com.
Zap; zapglue.com.



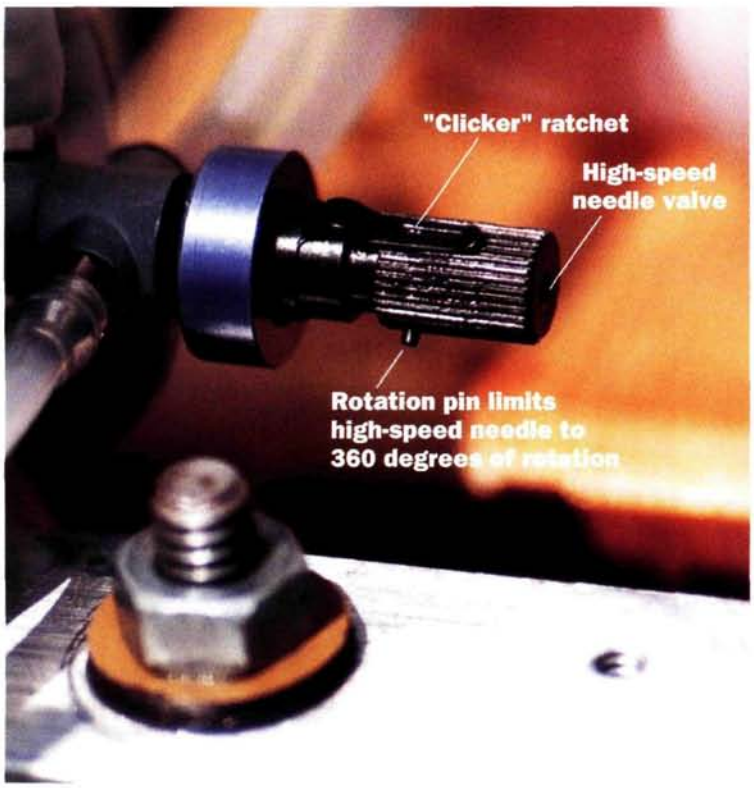
To order the full-size plan, turn to page 154, or visit rcstore.com online.

by Dave Gierke

The Evolution Power System



Way back in the '20s and early '30s, if you wanted an engine for your free-flight model airplane, it had to be machined and required a casting kit and a set of drawings. In 1934, Bill Brown manufactured the first commercially available RC engine in the United States; it was the Brown Junior .60 (Model B). Before aspiring modelers could run it successfully, they had to learn all about their new engine and what it involved: fuel tank, needle valve, gasoline, spark plug, breaker points, condenser, advance lever, battery, switch, etc. In 1947, Ray Arden introduced the glow plug; this eliminated the cumbersome spark-ignition system and greatly simplified engine operation.



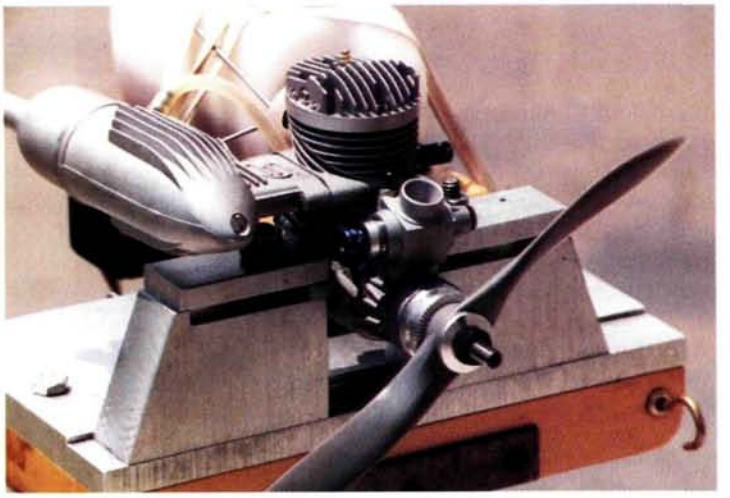
Note the high-speed needle valve's pressed-in radial rotation pin. As the pilot rotates the needle valve, the pin bumps into either side of the stationary ratchet; this limits its rotation to approximately 360 degrees.

During the next 20 years, many refinements found their way into model 2-stroke engines, primarily in design and materials. In the late '60s, the first ABC engines appeared in hobby shops. They offered several advantages over conventional designs, but none was more important to sport modelers than the short time required for break-in—less than half an hour, in some cases. Engines continue to become easier to operate, and a new engine—the Evolution Trainer Power System—now represents another paradigm shift, and it supersedes all the engines that came before it.

Produced and distributed by Horizon Hobby Inc., the Evolution Power System consists of a .455ci 2-stroke Alpha engine, a muffler, a 3-blade "training" propeller, a spinner and a flywheel for smooth running and easy starting.

Designed expressly for newcomers, the system incorporates several unique features that help to ensure immediate success.

- Every engine is test-run and broken in at the factory.
- The high- and low-speed needle valves have a limited adjustment range, and that minimizes the chance of error but allows fine-tuning to suit variations in altitude and/or weather conditions.
- The needle valves are adjusted for maximum wide-open throttle (WOT) and idle performance at the factory.
- The Evolution Power System comes with a reader-friendly users' manual that contains everything a beginner needs to know. Of particular interest is the description of how to set the high- and low-speed needle valves—impressive. In addition to installation, starting and adjustment instructions, the manual provides a parts list, a troubleshooting guide, a maintenance section and warranty information.



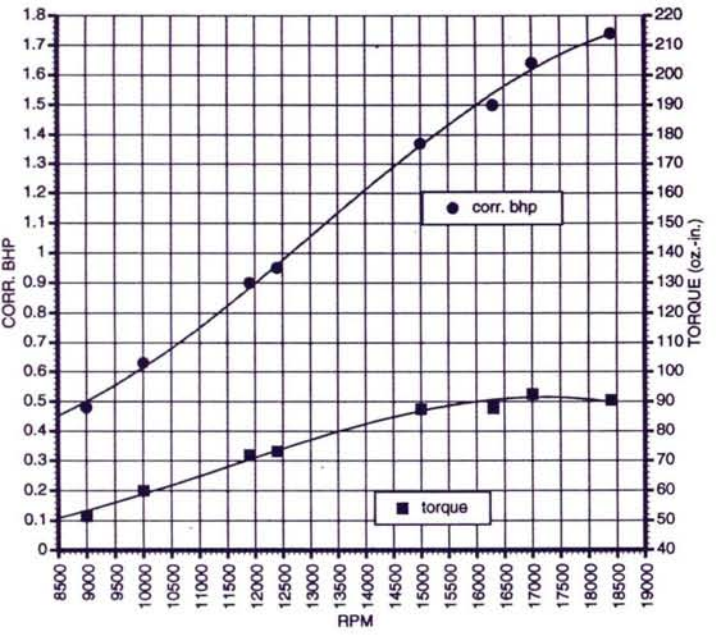
The test-stand setup with the flywheel and 3-blade propeller removed. I used a variety of commonly used APC propellers to determine how the engine would react to higher and lower loads. The results were surprising!

ENGINE CONSTRUCTION

Before I ran the Evolution, I disassembled it to check its design and the methods and materials used in its construction. The bead-blasted, die-cast crankcase has a unique arrangement of cooling fins that wrap around the crankcase from below the exhaust stack at the front to just below the cylinder head at the rear; this very distinctive look certainly won't be mistaken for any other design!

The Evolution .46 features a front intake and a side exhaust. The crankshaft is supported by two ball bearings, and the piston and cylinder sleeve are of the lapped ABC type. Cylinder-sleeve porting consists of two Schnuerle transfer ports and a single boost port. The aluminum-bar-stock connecting rod is bronze bushed at both ends and has the appropriate drilled lubricating holes. The hardened and ground crankpin is pressed into the offset portion of the massive counterbalance, while the bearing journals and nose threads have been case hardened and the bearing journals ground to final size.

Torque peaked at a very high 17,000rpm while horsepower continued to climb; its peak is at somewhere beyond 18,500rpm. Evolution suggests that the engine's practical operating range is between 2,000 and 16,000rpm; high-performance specialists may want to stretch its upper limits in their "go-fast" models. This powerplant sure likes rpm!



Test conditions: temp.—80 deg. F; horsepower correction factor—1.054; barometric pressure—29.41 in. Hg; wet-bulb temp.—66 deg. F.

The amply finned cylinder head has a hemispherical combustion chamber with an angled squish band; it has a special, long-snout "Super Plug" that purportedly prevents the engine from flaming out when it transitions from idle to WOT. The snout is designed to direct the fuel/air mixture away from the platinum-alloy wire element; in other words, it works like an idle-bar plug. The new Super Plug is available from Hangar 9 (item no. HAN 3006) and is worth trying in any engine that displays throttle and transition-related problems. [When you remove the glow-plug heat connector (battery), that the plug is slanted rearward also provides a degree of safety in helping you to avoid the spinning propeller.]

The 2-needle-valve fuel-metering carburetor incorporates a remote high-speed needle (mounted on the rear cover) with a press-fit axial pin that limits its rotation to approximately one turn (360 degrees). The low-speed needle valve has a similarly pressed-in pin that limits its rotation to about ¼ turn (90 degrees). Both needle valves are close to the required mixture setting as they come from the manufacturer. Although I had reservations about the limited range of the available needle-valve adjustment, the engine performed flawlessly throughout my trials. One full turn of the high-speed needle valve proved to be more than enough to adjust the air/fuel mixture.

Immediately below the carburetor cinch bar, the crankcase is fitted with an O-ring that eliminates any chance of the air leaks that are sometimes associated with other sealing methods; this great idea is catching on throughout the industry. The 2-ounce steel flywheel is pressed onto the aluminum prop driver's outer diameter; weight added to the crankshaft helps provide rotational momentum to the propeller; this helps to smooth engine operation and assists with starting.

In addition to the accessories already mentioned, the engine also comes with two muffler-to-crankcase gaskets and two, metric, Allen-type wrenches that fit the two sizes of machine screw used in the engine. The supplied 3-blade, 10.5x4.5 propeller provides superior ground thrust for takeoff and a relatively slow cruise speed; this allows novice pilots time to think!

The engine's expansion-chamber-type muffler contains a single, sound-deadening baffle as part of its two-piece design. Its aft portion contains a positionable exhaust outlet; its forward section has a pressure fitting as part of the fuel-delivery system.

The spinner and backplate components are made to exacting standards of white, injection-molded, high-impact plastic. You

SPECIFICATIONS

ENGINE: Evolution Trainer Power System

MANUFACTURER: Evolution Engines

DISTRIBUTOR: Horizon Hobby Inc.

DISPLACEMENT: 0.455ci

BORE: 0.867 in.

STROKE: 0.770 in.

SUGGESTED RPM RANGE: 2,000 to 16,000

WEIGHT W/MUFFLER: 19.52 oz.

MUFFLER TYPE: expansion chamber with baffle

PROPELLER (INCLUDED): 3-blade 10.5x4.5

GLOW PLUG: Hangar 9 Super Plug (HAN 3006)

SPINNER: 2 1/16 in. dia.

CARBURETOR: 2-needle; fuel metering; 0.275-in.-dia. choke

CRANKSHAFT NOSE THREAD: ¼-28

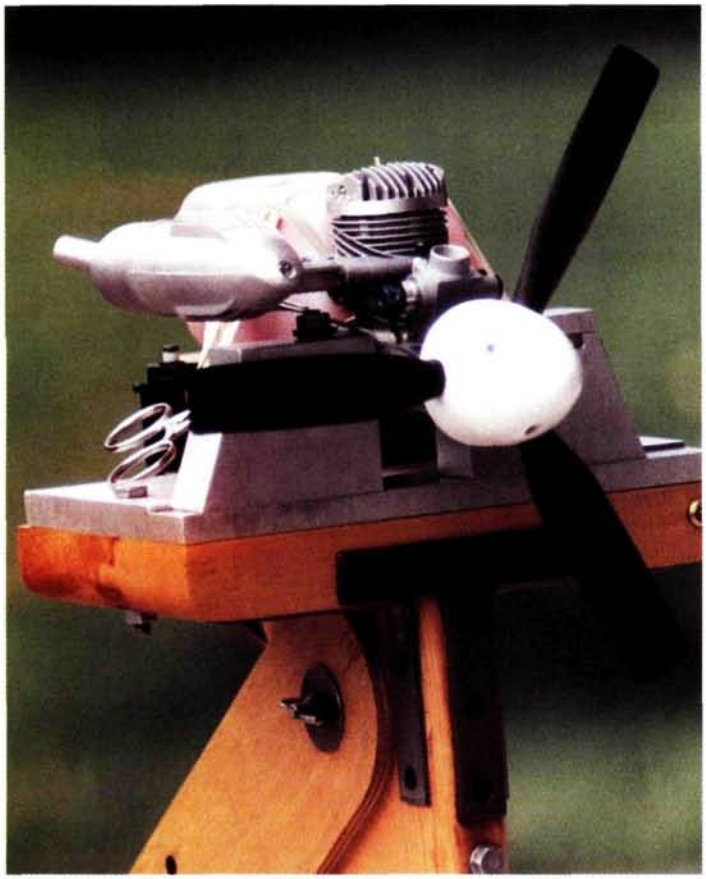
COMMENTS: this truly is a revolution in engine design. With high-quality components and factory break-in and tuning, this well-thought-out design will ensure the success of newcomers. It also has enough power to satisfy veteran sport fliers.

HITS

- Limited-rotation high- and low-speed needle valves.
- Flywheel prop driver.
- Quiet operation.
- Comprehensive, informative users' manual.

MISSES

- None noted.



The Evolution Trainer Power System (Evolution Alpha, flywheel, 3-blade propeller and spinner) is ready to run for the first time. I used Sig 10-percent-nitromethane fuel with 20 percent oil.

must mate them with three self-tapping screws after you have secured the propeller to the engine shaft.

RUNNING THE EVOLUTION ALPHA

For my tests, I used Sig 10-percent-nitromethane fuel; it contains 20 percent lubrication oil, half of which is castor and the other half, synthetic. I did all the tasks detailed in the users' manual: I mounted the engine on a test stand, set up the fuel tank and fuel lines and attached the throttle linkage, muffler, prop and spinner; then I filled the tank, choked fuel into the carburetor, attached the glow-plug connector battery and turned the engine over with the electric starter. The mill fired up immediately. I then adjusted the high-speed needle valve at the rear of the engine to maximum rpm (as indicated by my tachometer: 11,200). After about 1 minute, I throttled back to idle, where the engine ran steadily at 2,200rpm. After 10 seconds or so, I moved the throttle rapidly toward wide open, but the mill gagged and quit.

After allowing the engine to cool, I turned the low-speed needle valve about 45 degrees counterclockwise—rich. During the next run, the engine produced a satisfactory idle and a crisp throttle-up. For the next few minutes, I cycled the engine between idle and WOT without its hesitating or stalling. By the end of its third run (about 10 minutes), I noticed that the WOT rpm had improved to 11,500—a 300rpm increase. The cylinder-head temperature at this setting stabilized at 350 degrees F (about right for an engine of this size).

I checked the engine noise 9 feet away from it and at 90 degrees from the crankshaft centerline on the muffler side; I measured a very quiet 90dB, which is partly the result of having a good baffled muffler and partly owing to the 3-blade propeller. The final carb adjustment also resulted in a better than average idle rpm of 2,100.

DYNAMOMETER RESULTS

APC propeller	Rpm
8x6	18,300
8x7	17,000
9x6	16,300
9x7	15,000
10x6	14,000
10x7	12,600
11x6	12,400
11x7	11,900
12x6	10,000
12x7	9,000

DYNAMOMETER TEST

The dyno test results were enlightening. This is a very powerful mill, but it must be allowed to unload to higher crankshaft speeds. Notice that the peak torque isn't produced until about 17,000rpm, which is quite high; at that point, horsepower has yet to reach its maximum with the smallest load that I chose to use. At 1.74bhp at 18,300rpm, the engine's specific output is 3.4bhp per cubic inch (displacement). This is very high for a "trainer" power system!

With the 3-blade prop operating at 11,500rpm, the engine produces about 67 oz.-in. of torque and approximately 0.83bhp. The bottom line is that the engine isn't working very hard while it spins the 3-blade prop, and that will mean many hours of trouble-free operation from this combination.

On the other hand, more experienced modelers might consider trying this engine for other applications, including those fun-type sport pylon racers; it spins an APC 9x6 at 16,300rpm.

By substituting a conventional prop driver (provided in the kit) for the flywheel unit, I ran rpm tests for many of the APC propellers that we might use for the variety of airplane types commonly found at the flying field.

	RPM	TORQUE	CORR. BHP	CORR. FACTOR	BHP
1	8,500	–	–	–	–
2	9,000	51.5	0.48	1.054	0.46
3	10,000	60	0.63	1.054	0.6
4	11,900	72	0.9	1.054	0.85
5	12,400	73.2	0.95	1.054	0.9
6	14,000	67.7	0.99	1.054	0.94
7	15,000	87.4	1.37	1.054	1.3
8	16,300	87.8	1.5	1.054	1.42
9	17,000	92.5	1.64	1.054	1.56
10	18,400	90.4	1.74	1.054	1.56

CONCLUSION

Horizon Hobby has raised the bar with its Evolution Trainer Power System. With its high-quality components and high-performance, safe and simple operation, its clear users' manual, two-year warranty (and, if needed, Horizon's superb service center), this engine virtually guarantees the success of first-time flyers and seasoned veterans. ✈

APC Props; *distributed by Landing Products (530) 661-0399; apcprop.com.*
Evolution Engines; *distributed by Horizon Hobby Inc. (800) 338-4639; evolutionengines.com.*
Sig Mfg. *(641) 623-5154; sigmfg.com.*

PRODUCT REVIEW

by John Simmance

Upperspace DesignCAD 3D MAX Plus

A new dimension in CAD

Scratch-builders have benefited greatly from 2D, CAD drafting programs; they allow them to draw only one half of a design, and the computer will draw the mirror image. CAD drawings are precise, and copying and pasting allows frequently used items to be drawn only once and then replicated automatically as needed. Now, 3D CAD expands the design horizons exponentially, but many of its users face a common problem. Because model designs usually have to be printed full size, the .dwg and .dxf file formats are essential because they are the standards governing commercial plotters. But 3D CAD programs that can handle these file types (such as AutoCAD) tend to be very expensive—way beyond the average modeler's budget. This is where DesignCAD 3D MAX Plus (DCAD3DMP) comes in. This moderately priced and powerful 3D program can import and export not only .dwg and .dxf files but also IGES and Windows Metafiles. And DCAD3DMP can "read" scanned images (which AutoCAD cannot do) and import them as .dcd files. Scale scratch-builders will appreciate this because they will now be able to scan a 3-view into CAD and "trace" it; this will save much painstaking measuring and converting.

Most model designers will find that DCAD3DMP's range of 3D capabilities exceeds their needs, but it has one super feature that every modeler can use: the ability to transform 2D profiles of ribs, formers and interlocking parts into 3D "solids" and then "assemble" them to reveal inaccuracies. This beats discovering errors halfway through construction and resorting to emergency corrections! As designers know only too well, it is very difficult to spot your own mistakes. DCAD3DMP can spot them for you.

GET FAMILIAR

The program includes a 409-page illustrated manual and reference book. I installed it from the CD-ROM disc onto a 500MHz PC with Windows 98, graphics acceleration and 256MB of RAM. The typical installation requires 77MB on the hard drive, but a compact installation is an option; it needs only 18MB of hard-drive space.

The top image in Figure 1 (opposite page) shows the screen after boot up, following the optional "Tips of the Day" pop-up and after the selection of the "New Drawing" option. The uppermost horizontal command menu is the principal tool; it has a multitude of drawdown menus and draw-across sub-menus that cover all the available commands. Below that is a horizontal toolbar that contains basic commands, and underneath that, a coordinate bar shows the cursor position in 2D or 3D space, depending on whether the 3D mode is active. The distance moved from the last point set appears in the DX, DY and DZ boxes. Below that is the Double Line bar; it's useful for architects to use when drawing walls and for modelers to use when drawing stringers.

Vertically, on the left of the screen, are two drawing toolboxes. These are "self-customizing"; frequently used command icons automatically appear in the box, and the less frequently used vanish. Other toolboxes can be added and customized, and all can be "docked" in different locations. The drawing area shows the 3D tiled view on the right, and three tiled views on the left display the orthogonal X, Y and Z-axes. The 3D view can be rotated and toggled from perspective to isometric.

To the right and below the 3D view are scroll bars. Below the right vertical scroll bar is a vertical Zoom toolbar, which is very useful when navigating a busy drawing. Annoyingly, this toolbar vanishes whenever the orthogonal tile views are maximized, forcing the use of the View menu. This became so distracting that I created a custom Zoom toolbar to be visible no matter which view tile was maximized. On the extreme right is a vertical, Color toolbar. The status bar at the bottom indicates what is happening, but I regret the absence of an AutoCAD-type command window and command dialogue line. No doubt, most of these little annoyances are a result of my being used to other programs. Any modeler who uses DCAD3DMP from the outset will quickly become competent and will barely notice these points.

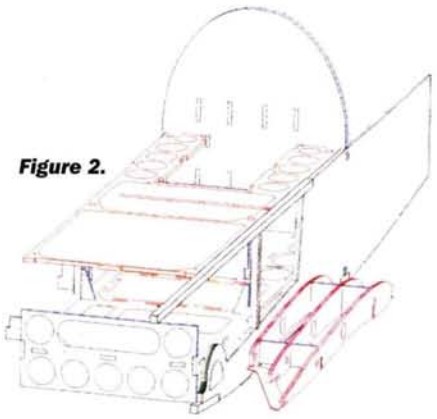


Figure 2.

One of the most useful features is that you can "assemble" separate pieces in 3D to check for errors. This section of a preexisting S.E.5a design was imported for this purpose.

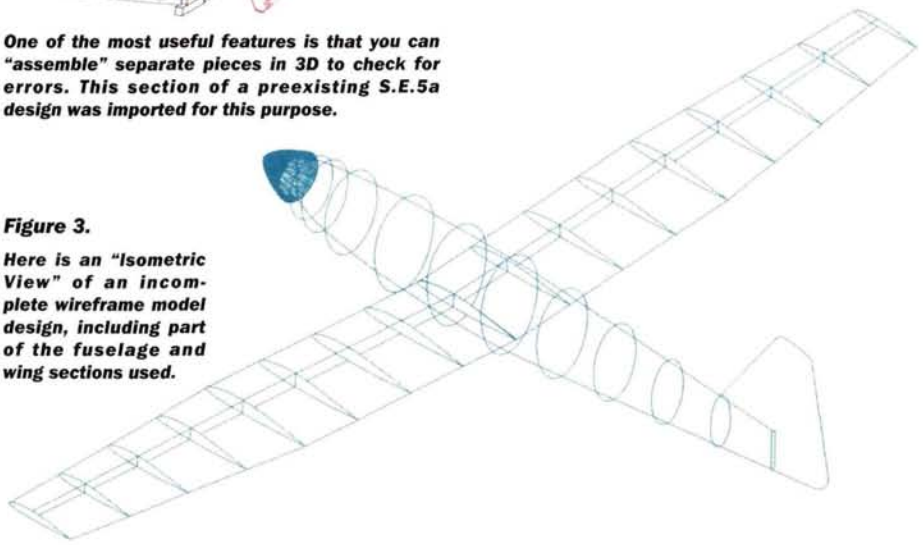


Figure 3.

Here is an "Isometric View" of an incomplete wireframe model design, including part of the fuselage and wing sections used.

WORKING WITH THE PROGRAM

In 2D mode, the program is intuitive and easy to learn. Any first-time entrant to CAD ought not venture too early or too far into 3D mode until he is quite comfortable in 2D. Once in 3D, you must pay great attention to proper orientation within 3D space.

Figure 2 shows an experiment to check the accuracy of the program by assembling component parts of an S.E.5a model. An AutoCAD .dwg file was imported, and the program converted it into a DCAD3DMP .dcd drawing. Part profiles were separately converted into planes and "extruded," according to their thickness, into "solid" entities. They were then oriented and rotated about their appropriate X, Y, or Z axes into a correct angular relationship with one another before any

attempt was made to "assemble" them into a whole. Then, piece by piece, I assembled the S.E.5a; I set handles prior to each move so that each part could be precisely positioned. The exercise was successful, and it revealed design errors that had previously eluded me.

When "assembling" parts to check for design accuracy, clarity is improved if different colors are used and if each part is defined as a "block"; this makes subsequent adjustments easier. My initial attempts to use separate layers and colors were frustrating. Layer and color control wasn't easy or intuitive, but a query to the helpful Upperspace technical staff resolved the issue.

The S.E.5a experiment also uncovered a small 3D quirk. Where components had lightening holes cut in them, these cutouts appear onscreen as thin outlines or fences rather than as actual openings. Although the "Hide Hidden Lines" command works well, it apparently does not take into consideration components with holes in them. This doesn't detract from the value of assembling solids to reveal errors; visualization is certainly much easier with the "Hide Hidden Lines" view enabled.

POINTS OF CONCERN

Of paramount importance is file compatibility. In one test, a large AutoCAD .dwg file was imported. Although it converted nicely to a .dcd file, one spline curve acquired a curious bump, but this was easily corrected. Of greater concern were the extensive text, captions and instructions. Although the information was reproduced completely, it was no longer in the same font or of the same size. Some text overlapped, and I was not able to convert the font or correct the size. The best solution might have been to re-enter the entire text, caption by caption, deleting old text as the new was inserted.

The Upperspace technical staff confirmed that because of differing text standards, occasional anomalies such as this do occur. When a 3D drawing, created entirely in DCAD3DMP but lacking text, was placed in 2D mode and exported in .dwg format, it opened quite normally in AutoCAD with no apparent anomalies. It retained some of the line thicknesses of DCAD3DMP.

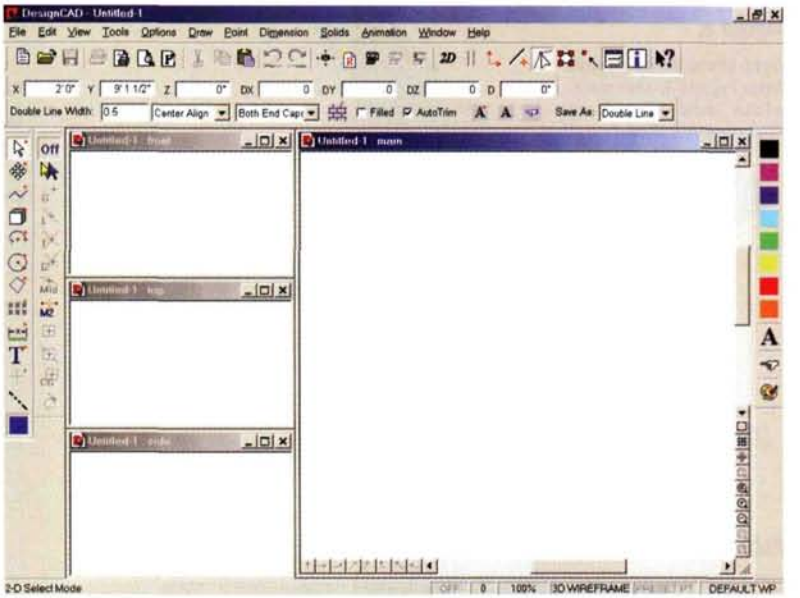
Figure 3, an isometric view, shows a stage in the 3D construction of a simple model design entirely in DCAD3DMP; it was first drawn in outline form in 2D mode, with fuselage cross-sections composed of elliptical arcs. The wing was then constructed in 3D in wireframe, with an Eppler 374 airfoil giving it form. The wireframe fuselage was assembled as already described, the spinner profile being swept into 3D. The tail surfaces were completed and extruded to form solids, and both wing and fuselage were "rounded" to 3D using the "Surface Connect" command. Model construction details were not drawn. The final perspective view is shown in Figure 4 (next page).

Another test involved directly scanning a 3-view into DCAD3DMP. Using a UMAX Astra 1200S scanner, the WW I biplane 3-view selected for the test appeared in .dcd format. To permit use in AutoCAD, the file was exported to .dwg. The export command worked perfectly, but the "Autotrace Bitmap" command must be selected to convert the raster files to vectors; without it, the exported file will appear blank. In the process, some of the lines became oddly distorted, but even so, the procedure would still greatly help scale modelers.

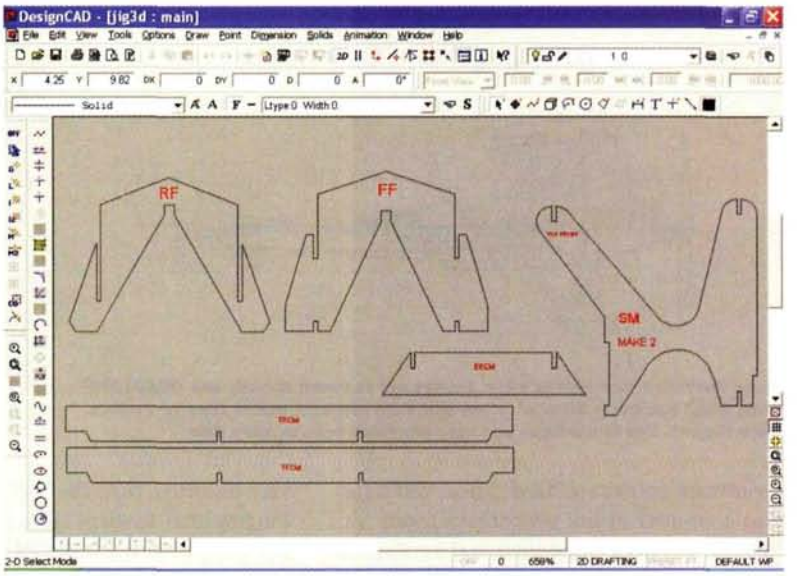
Figure 5 shows how the fuselage profile and front view ultimately appeared in AutoCAD .dwg file format. Although the 3-view was visible after it had been imported into .dcd, it could not be edited until the "Autotrace Bitmap" command had been executed.

Although possible, airfoil plotting when navigating by menu commands is cumbersome. Even if only 35 or so

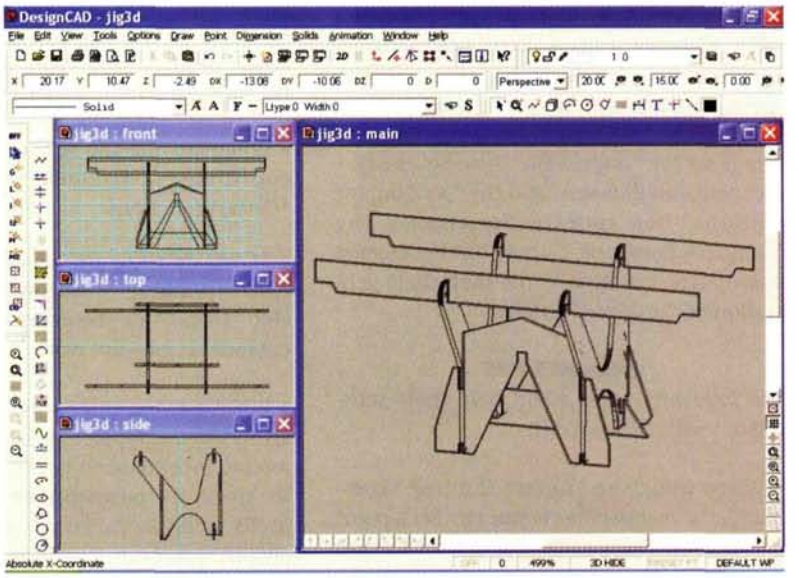
Figure 1.



This is how the screen appears after you boot up the program and opt to create a new drawing. The primary commands are arrayed in drawdown menus in typical fashion across the top of the screen, and the drawing toolboxes are arranged vertically on the left.



One of the most useful features is that you can "assemble" separate pieces in 3D to check for errors. This section of a preexisting S.E.5a design was imported for this purpose.



When the parts have been extruded and assigned the correct thicknesses, you can assemble them (as seen here) to check for proper fit and orientation. By selecting the "Hidden Lines Removed" mode, the object appears much as it will in real life.

Figure 4.

Here is the same design from Figure 3, now complete and shown in "Perspective View."

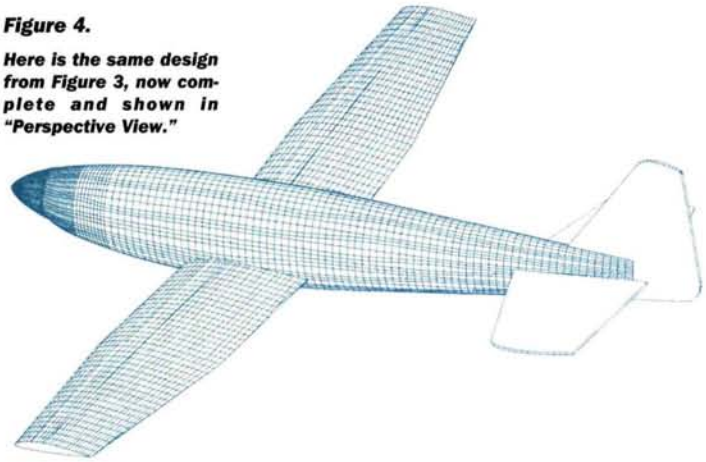
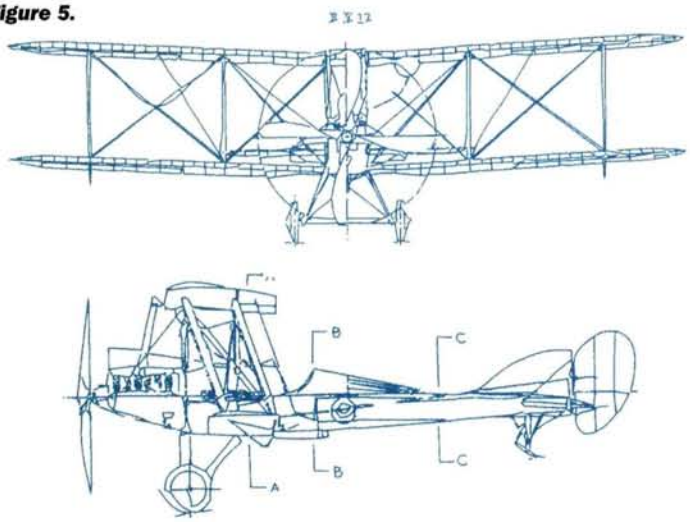


Figure 5.



Some distortion may appear when 3-views are scanned directly into DCAD3DMP using the "Autotrace Bitmap" command that converts raster files to vectors. Nevertheless, this feature can still save modelers considerable time.

SPECIFICATIONS

PROGRAM: DesignCAD 3D MAX Plus, Version 13

MANUFACTURER: Upperspace Corp.

TYPE: full-featured, Windows-based, 3D computer-aided drafting program

SYSTEM REQUIREMENTS: 486DX processor; 16MB of RAM; 18MB hard-drive space ("compact" installation); Windows 95, 98, ME, or Windows NT (Version 4.0 or later); Super VGA, 256-color graphics card; Super VGA monitor, 800x600 resolution.

RECOMMENDED SYSTEM FOR 3D FUNCTIONS: Pentium III 500MHz processor; 256MB of RAM; 77MB hard-drive space; 500MB swap file; OpenGL-compatible video card.

PRICE: $269.95 (download); $299.95 (CD-ROM)

FEATURES: DesignCAD 3D MAX Plus comes with a comprehensive reference manual and a CD-ROM installation disc (a downloadable version is also available). This powerful drafting program includes full 2D and 3D capabilities, customizable features and toolboxes and online help. It has import/export capabilities to and from .dwg, .dxf, HPGL, IGES and Windows Metafiles, and it can import scanned images.

COMMENTS: DCAD3DMP functions best with fast computers, large memory and enhanced graphics acceleration because it can produce intricate drawings and it runs somewhat slowly. The full capabilities of DCAD3DMP will probably be used more by engineers and architects than by modelers. However, because of its 3D capabilities, its power and its very affordable price, there is an extremely useful 3D function that model designers will truly appreciate: it can "assemble" designs that were first drawn in 2D mode in either DCAD3DMP or other CAD programs.

HITS

- Has the features of the leading CAD programs but at a much lower price.
- Easy to learn with an extensive reference manual.
- Can import and export other file formats, including .dwg and .dxf.
- Can import scanned images directly.

MISSES

- Some small anomalies when importing/exporting other file formats.
- Layer and color control aren't intuitive.

coordinate entries are needed (for "old style" non-computer airfoil coordinates), one airfoil plot required more than 400 keystrokes! It is much easier (and essential with multiple "computer" airfoil coordinates) to import the required data as an ASCII or .rtf text file. List the coordinates in a word processor, and enter each point on a single line; separate the X and Y coordinates with a comma, space, semicolon, or tab (I used commas).

From the File menu, selecting "Import" brings up the "Import File" box. Set the correct path and filename, and the "XYZ Import Options" box appears. For airfoils, the "Connect Points by Curve" option seemed appropriate, resulting in the immediate generation of the desired airfoil.

BEGINNER TIPS

The following notes might help those starting out with DCAD3DMP.

• When using the "Surface Connect" command, the manual directs you to: "Set a point on each line entity to be connected." I found it necessary to set those points as closely as possible in the same relative position on each line entity; if I didn't, the results could be very distorted. Note the slight waviness of the longitudinal fuselage lines in Figure 4. This occurred despite my careful setting of points in a similar relationship.

• Parallel lines are not drawn in the same layer, color, or style of the original line, but in those of the current layer. Before you draw parallels, make sure that the layer of the line you wish to parallel is current.

• When moving and setting points to precise coordinates, disable "Snap Grid" and "Ortho" functions.

• When drawing arcs or elliptical arcs and when trimming orthogonal lines, first disable "Ortho," or the drawing and trimming commands may not work.

• When moving entities, wait until the white arrow cursor appears before you move the mouse. Depending on your computer's processor speed, the program may run more slowly in 3D mode, so patience is essential. (On my 500MHz processor, it was rather slow.)

• Elliptical arc angles always proceed from the major axis to the minor.

• Remember to use "Refresh" or "Redraw" after multiple commands involving "Deletion" or "Trim," or some of the lines might temporarily disappear.

• When commands such as "Rotate" are made repetitively, instructions such as "Angle" and "Increment" must be reset because the last command setting isn't remembered.

• F3 is a useful shortcut; it repeats the previous command.

CONCLUSION

Overall, DesignCAD 3D MAX Plus is a powerful program that offers extensive 3D drafting capabilities at a fraction of the cost of the leading 3D CAD program. It is fairly easy to learn, particularly in 2D mode, and because of its file-exchange ability, it offers the model aircraft designer a unique method of checking 2D designs for accuracy. It works whether those designs were drafted in other CAD programs, or were newly drawn in 2D or 3D in DCAD3DMP from scratch. ✈

Upperspace Corp. (800) 233-3223; upperspace.com.

SEND IN YOUR EVENT COVERAGE. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.

4TH ANNUAL Vintage R/C Society Hal deBolt Reunion

by Art Schroeder

Every year, members of the Hernando Aero Modelers and the Vintage R/C Society, Chapter 2, gather for the annual Hal deBolt Commemorative Reunion. Now in its fourth consecutive year, the event takes place over the course of two days at the Sand Hill Boy Scout Reservation in Spring Hill, FL. It traditionally follows a two-day autogyro fun-fly event; combined, they make for nearly a week's worth of historic RC flying.

A "school" of Stark Sharks! Left: Ron Morgan with his stock Stark Shark; middle: the airplane's designer, Dick Allen. Dick flew the Great White Shark in front of him and the standard version to its right. Right: Lou Davila brought the smaller Shark in the foreground. No matter its size, this aircraft can outfly most of today's sport designs.

Lyman Slack's beautiful 1958 Livewire Custom Bipe as designed by Hal deBolt. This large biplane is a very popular design with VR/CS members. Four Custom Bipes were entered at Spring Hill, and all flew magnificently.

Right: this lineup of antique designs is dominated by Hal deBolt creations. As at most VR/CS reunions, deBolt designs accounted for half of the entries.

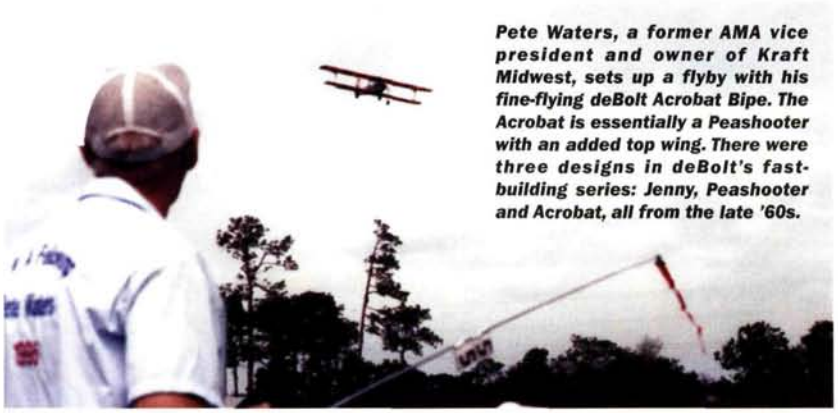
PHOTOS BY D. BOS, D. BURT, V. DEFEO, R. MORGAN & D. OGREN

Pete Waters and his impressive Ed Kazmirski Taurus. Built in 1965, it's finished with silk and dope and powered by a YS 45. Pete placed second in Class III.

The Spring Hill reunion is primarily a fun-fly but includes some low-pressure competition in three classes: Class I—rudder only (Jack Port Memorial), Class II—rudder and elevator (Howard McEntee Memorial) and Class III—rudder, elevator and aileron (Ralph Brooke Memorial). Participants compete with planes designed in the 1960s, and the combined totals of points earned for two flights determines the winners.

This Boy Scout Reservation is a perfect setting. A big field features a beautiful grass runway that's nearly akin to a carpet. Unfortunately, Mother Nature was not very accommodating. High winds on Saturday caused very turbulent conditions, but improved weather on Sunday allowed extensive flying.

Left: a deBolt 1965 Peashooter by Rich Suppes. This airplane brought a high level of prefabrication to RC as a Livewire kit and was a very quick build. Right: one of many Dick Allen Stark Sharks; this one was built by Ron Morgan. The Stark Shark has become a symbol of VR/CS. Many have been built in the first decade of VR/CS activity.



Pete Waters, a former AMA vice president and owner of Kraft Midwest, sets up a flyby with his fine-flying deBolt Acrobat Bipe. The Acrobat is essentially a Peashooter with an added top wing. There were three designs in deBolt's fast-building series: Jenny, Peashooter and Acrobat, all from the late '60s.

Pete Waters' deBolt-designed Acrobat Bipe. This design was produced when biplanes were rare, and it was an answer to the famed Aeromaster. A .40 engine does the trick for very impressive patterns.

Left: well-known RC writer Stu Richmond and his Herb Greenberg-designed Red Zephyr.

Below: Walt Keating's Custom Bipe was one of four flown. This design doesn't use ailerons yet responds in rolls as if it did. The Custom Bipes need only a .45 to .60 engine for power. Virtually all planes at VR/CS events are scratch-built from original plans.

This Ben Shereshaw design as kitted by Scientific in the '30s is rarely seen. Called "Mercury," it is a certified early airframe that some RC'ers used before purpose-designed RC aircraft were available.

You will never find a more hospitable RC group than the Hernando Aero Modelers.

The number of vintage aircraft that circled the skies over Spring Hill was definitely up from last year. And, as it is at most VR/CS reunions, Hal deBolt-designed models outnumbered all others by far.

This year, we had the pleasure of being joined by several of RC's legendary personalities, including Joyce Good, wife of the late Dr. Walt Good who was considered by many to be a founder of radio-control flight; Carl Schmaedig, a pioneer in both free-flight and RC; AMA historian Norm Rosenstock; Ron Morgan, director of the AMA Nationals; Brayton Paul, early innovator in RC; columnist Stu Richmond; and Pete Waters, former vice president of the AMA and owner of Kraft Midwest.

The highlight of any VR/CS event is the introduction of a true vintage model—one that was actually built in the year it was designed and that has survived to the present day. This year, Delmar Johnson presented a true piece of history—a Walter Good-designed WAG! Built in 1955 from *Model Airplane News* plans, it was originally powered by an ignition Forster 29 and controlled by a carrier on/off, single-tube radio (also published in *Model Airplane News*). A year ago, Delmar restored the airplane to new with a silk and dope finish and brought it into the 21st century by installing an AstroFlight FAI 15 motor and a Futaba 3-channel system.

More history emerged as an original Airknocker, built and finished by the famed designer and former *Model Airplane News* editor Bill Winter. Now owned by AMA historian Norm Rosenstock, the Airknocker is powered by an O.S. 15 engine but remains in its original 1960 condition.

Brayton Paul brought his scratch-built Hi-Tail-It that was entered in the 1958 Nationals as a rudder-only design. Characterized by its unique T-tail, this model really stands out. Today, it's powered by an Enya engine and controlled by a Futaba radio.

As in years past, everyone gathered on Saturday evening for the presentation of awards, among the most notable of which is the Walt Good Lifetime Achievement Award. This year, it went to Dick Allen for his many contributions to the hobby. Previous recipients include Hal deBolt, Ted Strader and Walt Good.

Thanks go to the Hernando Aero Modelers and contest director Don Ogren for another memorable year.

Ron Ogren proudly displays his Buzzard Bombshell. Ron is the twin brother of contest director Don Ogren.

PRODUCT REVIEW

ELECTRIFLY TRITON

Universal battery-care system

The Triton's optional thermal probe clamps go around NiMH and Li-poly packs to monitor their temperature.

by Dave Robelen

The Triton was my first experience with a "computer" battery processor. After reading its spec sheet, I realized that this little aluminum and plastic box will do just about anything short of changing the baby and walking the dog. It certainly has quite a bag of battery-processing tricks! Bear in mind that I am not an electronics wizard; I will try to convey how the Triton processes batteries.

At first glance, the Triton's manual is a little daunting: lots of pages and small type. As I read it, however, I realized that a lot of thought went into making this device simple to program. In just an evening, I was comfortable stepping through the options and changing the settings.

HOW IT WORKS

The Triton is able to process:

- 50 to 2400mAh Ni-Cd cells;
- 300 to 3300mAh NiMH cells;
- 145 to 3000mAh Li-poly or Li-ion cells;
- 4.5 to 10Ah lead-acid cells.

A very convenient table in the manual gives the various recommended charging rates for break-in, standard charge and quick charge. It details the peak-detection sensitivity for the different battery chemistries as well as the recommended discharge currents and cutoff voltages. This table alone is highly informative, and I learned a good deal by studying it.

The manual strongly recommends that you use the Triton Thermal Probe accessory when you charge NiMH, Li-ion, or Li-poly batteries. Since this does not come with the basic unit, I ordered one to use with these cell types. This accessory is designed to be clamped around the battery pack and to make direct contact with the cells. In some cases, e.g., with an assembled pack, you may have to trim away some of the heat-shrink covering. The probe will fit packs with A- to AA-size cells.

There are two ways to power the Triton: connect it to a 12V battery of adequate current capacity (I used my car battery for this); or use a benchtop power supply that converts the AC power to 12 to 13.8 volts DC. I learned that this power supply must have a capacity of more than 5 amps, as the Triton immediately tripped the breaker on my 5A adjustable supply. No problem; I found a good deal on a 12V, 12A power supply on the Internet, and it works just fine. These types of charger seem to multiply the charging voltage so that they draw a large current on start-up and then drop to a lower value.

The Triton's input clips are convenient, and it's protected against reverse polarity. The Triton also comes with a pair of color-coded banana jacks to hook up to your packs. Plugs and cables aren't supplied, so I picked up the necessary bits from RadioShack. Meanwhile, I also rounded up a connector for the battery end and made up a patch cord to connect to my packs. I still needed several patch cords with a variety of plugs for the various batteries I use. Fortunately, the Triton's output is also protected against reverse polarity, as it would be easy to inadvertently plug the banana jacks into the wrong sockets.

In general, I found the Triton quite convenient to use on the bench and in the field. That you can store the information for up to 10 packs in its memory is a really useful feature. A minor limitation is that its maximum rated charge current of 5 amps is available only over the 8- to 18V range; below and above those figures, the current gradually declines to about 2 amps. The same is true of the discharge feature: the maximum current of 3 amps is available up to 6 volts and then tapers off to 0.5 amp at 40 volts. From a practical standpoint, this is no big deal, and the handy chart offers advice on what's possible for each combination.

The Triton's charge/discharge feature provides a way to check battery capacity, and its discharge/charge mode ensures a maximum cell charge. The audio signals that indicate the end of a charge or discharge are loud enough to ensure that you'll hear them while you work on other projects. The Triton makes it possible to have only one charger for just about all of my battery needs, and I appreciate that.

ElectriFly; distributed by Great Planes Model Distributors (800) 682-8948; (217) 398-6300; electrifly.com.

SPECIFICATIONS

PRODUCT: Triton

MANUFACTURER: ElectriFly

DISTRIBUTOR: Great Planes Model Distributors

TYPE: universal battery charger, discharger and cycler

BATTERY TYPES AND NO. OF CELLS: 1 to 24 Ni-Cd (50 to 2400mAh), 1 to 24 NiMH (300 to 3300mAh), 1 to 4 Li-ion or Li-poly (145 to 3000mAh) and 6, 12 and 24V lead-acid (4.5 to 10Ah).

DIMENSIONS: 6.2x4x2 in.

WEIGHT: 16.4 oz.

INPUT VOLTAGE: 10.5 to 15 volts DC

FAST-CHARGE CURRENT: 0.1 to 5A linear (2.5A max. for Li-ion, Li-poly)

TRICKLE-CHARGE CURRENT: 0 to 250mAh (not available for lead-acid, Li-poly, Li-ion)

DISCHARGE CURRENT: 0.1 amp to 3 amps (2.5A maximum for Li-poly, Li-ion)

DISCHARGE CUTOFF VOLTAGE: 0.5 volt to 1.2 volts per cell Ni-Cd, NiMH (0.8 volt/cell fixed during cycle); lead-acid fixed at 1.8 volts/cell; Li-ion, Li-poly fixed at 3 volts/cell

CYCLE COUNT: 1 to 10 cycles (not available for lead-acid, Li-ion, Li-poly cells)

PRICE: $129.99 (Triton); $8.99 (optional thermal probe)

FEATURES: this computer-processor battery charger, discharger and cycler will work with all types of battery cells and has 10-battery-pack memory storage.

COMMENTS: I like having just one charger to meet almost all of my battery needs. Although the Triton has many features, it is very intuitive and programming isn't difficult; the folks at ElectriFly spent a lot of time designing this easy-to-use unit. A very convenient chart in the manual gives the various recommended charging rates for break-in, standard charge and quick charge.

HITS

- Works with all types of battery.
- Easy to use and program.
- Great manual.

MISSES

- None.

PHOTOS BY GERRY YARRISH

Awesome in size and performance, the gigantic 46-percent TOC Ultimate from Hangar 9 is an example of what today's ARFs are all about!

Big ARFs & new products

I am amazed by the continued development of impressive almost-ready-to-fly (ARF) kits. Far removed from their simple box-like trainer beginnings, ARFs are available today for models of all types and sizes. From small electric park flyers to IMAA-legal, gas-burning aerobatic planes (and everything in between), a very large portion of today's kit sales are of the prebuilt variety. When you consider the cost and time involved to build a comparable model from a wood kit or from scratch, the ARFs' prices are hard to beat. In our high-speed, computer-driven world, ARFs are a blessing to those who have little time for the workshop.

Earlier this year, I attended a local IMAA meet; I estimate that about 15 percent of the planes there were ARFs. Several years ago, prebuilts would have accounted for less than five percent of the models registered at such an event. The quality and workmanship of these quick-to-build models are at an all-time high. Recently, I helped my flying buddy Sal Manganaro review the new Hangar 9 46-percent TOC Ultimate 10-300 ARF biplane for the October 2003 issue of *Model Airplane News*. Being able to help build this model and having a chance to fly Sal's new giant aerobat showed me a

Editors Rick Bell and Roger Post hold on to the big Ultimate during engine run-up.

My current building project: a ¼-scale Fokker D-VII from Arizona Model Aircrafters.

great example of the current state of the art. If you think back to the first few giant-scale models that you built and flew, you'll see that today we are enjoying the Golden Age of ARFs.

CURRENT PROJECT

And talking about IMAA-legal ARFs, my current project is a ¼-scale Fokker D-VII from Arizona Model Aircrafters. With a wingspan of 88 inches, the Fokker is about 70 inches long, and it should weigh about 20 pounds when completed. The kit is based on Gary Allen's plans (FSP02981) that were featured in the February 1998 issue of *Model Airplane News*. Gary's design uses traditional balsa and plywood construction, and he incorporated a very scale airfoil cross-section in the wings; the outline is very accurate. As it's a true, stick-built scale design, the kit is not your typical ARF. I would describe it as a "partially built" kit, and there is enough workbench time needed to keep even an "anti-ARF" modeler happy. There's plenty of soldering required to assemble that shock-absorbing landing gear. The beautifully molded fiberglass side panels and engine cowl save time and add to the aircraft's accurate scale outline. Available as an ARF and an almost-ready-to-cover (ARC), these kits offer plenty of opportunities for you to change or modify things to your liking. The kit cuts overall building time by 75 percent, and Arizona Model Aircrafters offers many scale accessories—such as dummy engine cylinders and spoked wheels—to dress up your finished model. When you have finished with your project, no one will ever know you built it from an ARF kit.

The MSA-10 from Futaba can operate up to 4 servos from a single receiver output port.

Tru-Turn's new Wide-Blade spinners are sure to be a hit with the 3D folks.

As you can see, my model is just about ready for painting, and I have only 30 to 40 hours invested in the project. My kit came covered in white Solartex, but you can also buy it covered in Arizona Model Aircrafters' four-color, lozenge-camo printed fabric. I plan to fly the model at the upcoming RC Jamboree at the Rhinebeck Aerodrome in Rhinebeck, NY, so do me a favor and don't tell anyone it's an ARF!

NEW PRODUCTS

Many of today's giant-scale aerobatic models require two or more servos to move each of their control surfaces. You must install

multiple servos and control linkages and connect them to a mutual surface. That seems simple enough; just add a Y-harness and plug everything in; but what if your servos don't have the same centering or endpoints? Mismatches in servo performance can cause them to fight each other, and this increases current drain on your flight pack. Futaba now offers the MSA-10 Multi Servo Adjuster, and it takes care of any arguments your ganged servos may have. Just plug the unit into the receiver, and then plug up to four servos into it. The MSA-10 allows you to select each servo individually and adjust its travel direction (servo-reversing), neutral point and endpoint settings to synchronize their functions. You can also plug an auxiliary battery pack (4.8 to 6 volts) into the unit to power the servos directly to reduce the load on your main airborne pack.

The MSA-10 is also great for non-aerobatic models, and it can be used anywhere you'd install a Y-harness to operate two servos (dual ailerons and dual elevator halves come to mind). If one of the servos moves in the wrong direction (a common problem in dual-elevator-servo setups), simply use the rotary switch and the two push switches, and you have two perfectly matched servos that work in "mirror image"! Do you want dual aileron servos with differential throw (more up than down)? There's nothing to it—even if you don't have a computer radio. Priced at $59.99, the MSA-10 is a great radio accessory. After you've used it, you'll wonder how you ever got along without one. Give it a try; I know you will like it.

Tru-Turn offers spinner-adapter hardware to fit almost any engine. The twin jam-nuts on the right are particularly helpful for 4-stroke engines.

BIG-CUT SPINNERS

The 3D aerobatic craze is taking our hobby by storm, and many excellent models—large and small—are being specially designed to perform these outrageous maneuvers. Hovering, torque rolls—you name it! There's a model out there to do it. One of the requirements for 3D flight is low-pitched wide props. Available for several engine sizes, Tru-Turn's Wide-Blade spinners are designed specifically for the popular APC "W" propellers. The 2-inch Ultimate Bipe-style spinner shown is intended for .91, 2-stroke and 1.0, 4-stroke engines, and it will accommodate 13x4, 13x6, 14x4, 15x4 and 15x6 wide-blade props. The Wide-Blade spinner is longer than the standard Ultimate Bipe spinner to allow for engines with longer prop shafts and the necessary double-locknut arrangement for big, 4-stroke engines. You can go to the Tru-Turn website at tru-turn.com and see the differences between the standard 1.20-size spinners and the new Wide-Blade versions. Tru-Turn has an enormous selection of prop-shaft adapters and jam nuts as well, so call for prices. When it comes to precise balance and durability, Tru-Turn is the place to go.

NELSON SERVO WHEELS

The new servo wheel from Nelson Hobby Specialties is a great new accessory that eliminates yet another failure point in our control systems. Often, a molded-plastic servo wheel can strip out under high stress. This can happen when you use plastic servo wheels and arms with metal-gear servos that feature metal drive splines. Nelson's new servo wheels are precisely machined from 6061-T3 aluminum and have a unique clamping feature that securely locks them into place. Just tighten the 2-56 socket-head screw and locknut; there's no way this servo wheel is going to part company with your servo. Priced at about $9, these wheels are available for Futaba and JR (the JR wheel will also fit Airtronics servos), and they match up nicely with Nelson's other single- and double-arm servo accessory packages.

Nelson Hobby Specialties' new aluminum servo wheel has a clamping feature that locks it securely onto your servo.

Well, that's it. If you enjoy building and flying giant-scale models, tell me what you think; I welcome your comments or questions. You can email me at gerryy@airage.com, or you can write to me c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Arizona Model Aircrafters (480) 348-3733; arizonamodels.com.

***Futaba Corp. of America;** distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; futaba-rc.com.*

***Hangar 9;** distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.*

***Nelson Competition Engines** (412) 538-5282.*

***Tru-Turn Precision Model Products;** distributed by Romco Mfg. (713) 943-1867; tru-turn.com.*

PRODUCT WATCH

AT MODEL AIRPLANE NEWS, we not only tell you what's new, but we also try it out first so we can bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

GWS

Speed 400 motors

Inexpensive power source

The Speed 400 motor has been popular for many years. Direct drive, it can power a model that weighs up to 20 ounces, and with reduction gearing, it can handle a plane that weighs 30 ounces or more. Typically, a motor of this size is powered by 7 or 8 cells of up to 1000mAh capacity.

GWS now offers a full line of direct-drive and geared Speed 400 motors with spinners for about $17 each. The geared motors can come with gearing as small as 2.14:1 or as large as 6.3:1. GWS also offers several accessory motor mounts. Balsa Products supplied the direct-drive and geared motors I evaluated.

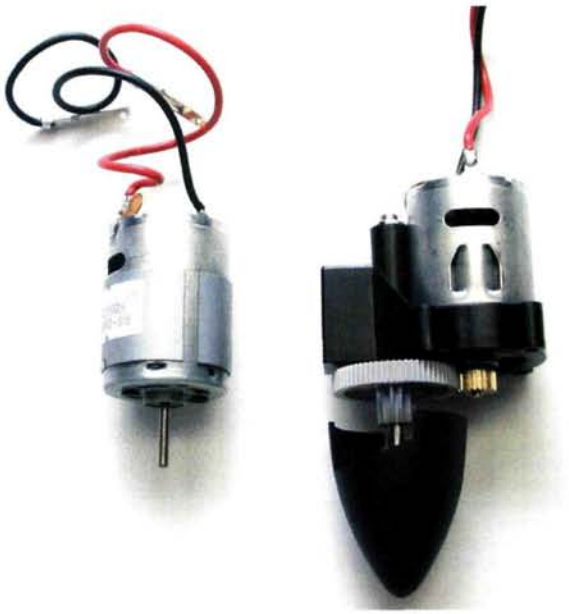
The direct-drive GW/EDP-400C (EP7035) motor came with two GWS 7x3.5 props, a prop adapter and a wrench. I ran the motor on a 7-cell, 8V pack and with the 7x3.5 prop to produce 11 amps at 87 watts and 11,800rpm. The motor, prop and adapter combined weigh 3.3 ounces. A capacitor from each terminal is attached to the motor case. Red and black wires that are approximately 5 inches long are already soldered to the motor terminals.

I also received the GW/EPS-400C/Std-E motor, which is geared 3.4:1. It came with just a spinner. Most GWS props will fit directly on the shaft. The motor with a gearbox and spinner (without a prop) weighs 3.7 ounces. GWS recommends that you use a 12x8 prop.

When I used a 10x4.7 prop on an 8-cell, 9V pack, the motor produced: 9.6 amps at 86 watts and 5,000rpm. The 427 grams (15 ounces) of thrust that GWS claims it produces can easily support a 30-ounce model.

If the popularity of the GWS IPS series is any indication, these new Speed 400 motors will soon power many of our favorite electric models. The wide range of gearings sizes is also a big plus for modelers who want optimum performance.

—Bob Aberle



Above: the direct-drive GWS Speed 400 motor (left) and the geared E version (right) cost about $17 each. Right: here's a close-up of the geared motor that I tested. It not only has the 3/8-inch square hole but four, forward-mounting holes that to make it easier to mount the motor to the firewall.

GWS; distributed by Balsa Products (732) 634-6121; balsapr.com.
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R/C Direct

Berg-4*DSP

Full-size performance from a micro package

The revolution in small, light, yet high-performance radio equipment continues with the introduction of the Berg-4*DSP "Micro Stamp" receiver. This sophisticated, microprocessor-based FM receiver has all the performance of a full-size unit, yet it weighs only 0.3 ounce in its hard plastic case with crystal and antenna and 0.25 ounce when wrapped in the supplied heat-shrink tubing.

As its name implies, this 4-channel receiver has about the same footprint as a commemorative postage stamp and is less than ¼-inch thick. Its single conversion design and careful implementation allow it as much range and selectivity as a high-quality full-size receiver. Because it uses a digital signal processor to decode, the servos and speed control "see" clean signals even if the incoming signal is less than perfect. It's also small and light enough to be used in a lightweight park flyer or an indoor model. Thanks to its high performance, busy indoor venues or flying fields aren't a cause for concern the way they can be when you use other small, light receivers.

The Berg-4*DSP also features over/under connections for the servos that make the unit thinner than other receivers, and an LED counter displays signal losses as a series of flashes to give you real-time feedback on the quality of the signal it's receiving.

I have several of these receivers in service. One is in a Todd's Models Wing-E. My ground range quadrupled when I installed it, and since then, I haven't had a single glitch in flight. I put another in my Todd's Models Tiny-X. In this case, I also use an E-Cubed M72 antenna installed inside the right wing. Lately, I have been flying the Tiny-X indoors in a large, metal-framed hangar—often with several other planes at the same time. Again, I haven't had a single glitch.

The Berg-4*DSP has only been available in a negative-shift version (compatible with Futaba and Hitec transmitters), but by the time you read this, a positive-shift version (for JR, Airtronics and Multiplex) should be available as well.

I am converting all of my small 3- and 4-channel models to the Berg-4*DSP, and I wouldn't hesitate to use it in any plane—large or small. I highly recommend this $60 unit.

—Bernard Cawley Jr.

R/C Direct (858) 277-4531; rcdirect.com.

CORROSIONX

Corrosion Technologies Corp.

Protect your RC equipment

Widely used by the military, CorrosionX is more than just a corrosion-control product; it's a super lubricant and is absolutely the very best penetrant I've ever laid my hands on. You can also spray it on your electronics to create an ultra-thin film that will help prevent moisture from reaching the wires and boards and ruining the circuitry. To test its effectiveness, I immersed a receiver with a plugged-in servo, a switch harness and a battery pack in CorrosionX. I was surprised that everything worked just fine even while the parts were completely submerged!

Here are two examples of what CorrosionX can do for you. I recently accidentally flew my Northstar into the water and soaked the radio equipment; when I checked the radio, nothing worked. I removed the receiver, blew out most of the water and then sprayed it, the battery and the switch with CorrosionX. After I plugged all the servos into the receiver and checked the radio again, I found that one servo and the gyro did not work, so I removed them, opened their cases and sprayed CorrosionX on the circuit boards. When it tested it again, all the parts worked as well as they had before!

In another incident, a wind gust caused my electric Playboy to land in about 8 inches of water. The motor, speed control, battery and switch were all wet, and when I tried to run the electronics, nothing worked. I removed the wet items and sprayed them with CorrosionX and also sprayed the gearbox and the motor through the holes in the case. After the parts had dried, they all worked perfectly. If I had not used the CorrosionX, I'm sure these units would have been ruined because electrical items and water do not mix well.

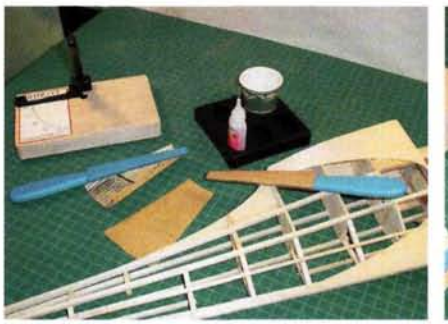
CorrosionX is recommended for all climates but especially where there is high humidity. It's also an outstanding an after-run treatment. —*Charlie Viosca*

Corrosion Technologies Corp. (800) 638-7361; corrosionx.com.

FOURMOST PRODUCTS

Sanding Sticks

Low-cost, versatile sanding tool



Every once in a while you come across a new tool that is handy, versatile and easy to use, and you ask yourself, "Why didn't I think of that?" Well the new Fourmost Products Sanding Stick is all that and more. It measures 8½ inches long and is molded of a lightweight, durable plastic. Its tapered sanding surface is flat on one side and rounded on the other, so it can access those narrow, difficult-to-reach areas that every model seems to have. The Sanding Stick comes ready for use with a piece of 120-grit sandpaper attached. The package also contains a page of six patterns so that you can cut various grits of sandpaper to fit the tool to replace the sandpaper when it's worn out. For greater convenience, Fourmost sells a package of precut sandpaper with two pieces each of 120-, 180- and 220-grit.

The Sanding Stick's unique, tapered slotted design doesn't require the use of adhesive-backed sandpaper. Instead, the sandpaper is wrapped around the taper and the edges are then folded into a slot to secure it. Depending on how you wrap the sandpaper around the tool, you can have an uninterrupted sanding surface; it's easy to position the seam on either the rounded sanding surface or on the flat portion.

I put the Sanding Stick to the test on the latest kit I'm building: a Dynaflite S.E.5a. As you know, after you punch out die-cut parts, the edges must be smoothed of any irregularities. I'd normally use a sanding bar for that job, but it is difficult to sand slots and cutouts with a bulky sanding bar. The Sanding Stick makes it easy to sand slots, cutouts and the inside diameters of holes of various sizes, so a tiresome task is handled quickly. At a cost of only $3.95 per Sanding Stick and $2.95 for a package of precut sandpaper, you could have several handy and preloaded with different grits of sandpaper for various sanding jobs. A paltry sum for a tool that will do so much. —*Rick Bell*

Fourmost Products (888) 857-9049; fourmost.com.

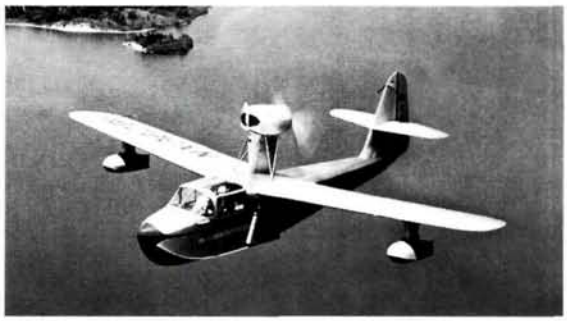
NAME THAT PLANE

Can you identify this aircraft?

SEND YOUR ANSWER to *Model Airplane News*, Name That Plane contest (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.

The winner will be chosen, four weeks following publication, from correct answers received (delivered by U.S. mail) and will be awarded a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will be given a free, one-year subscription extension.

Congratulations to Tom Clapsadle of Clinton, OH. Tom takes home top honors this time for correctly identifying September's mystery plane as the Goodyear GA-2 Duck—a single-seat pusher plane. Developed from the GA-1 prototype, which first flew in September 1944, the 36-foot-wingspan Duck featured fabric-covered wings and used a Franklin 113hp engine for power. Thirty-seven GA-2 and GA-2Bs (powered by a 165hp Franklin engine) were eventually produced. One GA-2B went to Sweden, but most of the completed planes were used only as dealer demonstration models. Four sets of wings, however, were sold for use on the 1947 Fulton Airphibian. Rising production costs eventually forced the cancellation of the project, and the last remaining Duck was scrapped in 1965.



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BY BOB ABERLE

Electrifying breakthrough!

How one flyer ingeniously used Li-poly cells to increase flight time and save weight

If you think that Lithium-polymer (Li-poly) batteries are just for small electric planes, you haven't seen Dave Grife's giant-scale Travel Air Mystery Ship. With Li-poly power, this plane achieves up to 20-minute flights!

Dave has flown his ¼-scale plane on electric power for about nine years using an AstroFlight 90 cobalt motor and up to 40, 2400mAh Ni-Cd or NiMH batteries; that setup weighed 19 pounds! The system produced approximately 45 amps of motor current, and flight times lasted about 4 to 5 minutes with some throttling. At the Mid-America E-FLY in Livonia, MI, last summer, he showcased his new and improved power system: a prototype Hacker brushless motor (Acro C50 geared 6.7:1) and 3, 3S4P Thunder Power Li-poly packs. Each pack consists of 12, 1950mAh cells wired in both series and parallel. These substitutions reduced the weight of the Travel Air Mystery Ship from almost 19 pounds to only 15½ pounds.

The real story is that the 36 Li-poly cells that replaced the 40 Ni-Cd cells reduce the model's weight by 36 ounces while nearly tripling the capacity; it went from 2400 to 7800mAh! The prototype Hacker Acro C-50 motor is also more than 1 pound lighter than the 90 cobalt motor, and it provides a nice efficiency boost.

Here's how Dave accomplished this:

• **The power boost.** Each Li-poly pack contains 12 cells and is designated 3S4P, meaning that 3 cells are wired in series, and four of these sets are connected in parallel. At full charge, the 3 cells in series provide around 12.6 volts, and that is similar to the voltage of a 10-cell Ni-Cd or NiMH pack. Because the packs are also wired in parallel, they provide four times the capacity of the individual cells (4x1950mAh=7800mAh). Dave needed more than 30 volts to run the Hacker motor, so he wired 3 Thunder Power 3S4P packs in series (3x12.6 volts) for 37.8 volts at 7800mAh.

• **The weight loss plan.** The original battery consisted of 40 sub-C cells; each cell weighed 2.1 ounces for a total of 84 ounces, or 5.25 pounds. A single Thunder Power 3S4P Li-poly pack weighs 16 ounces, so 3 of them weigh only 48 ounces. Do the simple math, and you can see that the model lost 36 ounces, or 2.25 pounds, in battery weight alone!

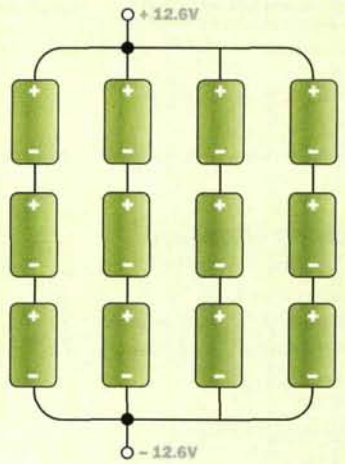
• **The bottom line.** Because each Thunder Power 3S4P pack costs $190 (assembled, balanced, tested and ready-to-run), the Travel Air Mystery Ship carries almost $600 worth of batteries! To make the investment more palatable, Dave configured all of his large electric models to run on these packs. That isn't a bad investment when you consider that Dave's entire hangar benefits from the weight reduction and that he has seen a 300-percent increase in flight times!

• **Charging ahead.** Dave charges his 3S4P packs with a prototype Li-poly-capable AstroFlight 110 Deluxe charger that charges 1, 3S4P pack at 8.2 amps, 2 packs at 6.5 amps, or all 3 packs simultaneously at 5 amps. At these currents, the packs reach 90 percent of full capacity in about 1 to 2 hours (depending on whether Dave charges 1, 2, or 3 packs). At the field, Dave can fly for 20 minutes on a single charge. What about field charging? It isn't necessary. As Dave puts it, "Twenty minutes is a lot of flying when it comes to a big plane like this!"

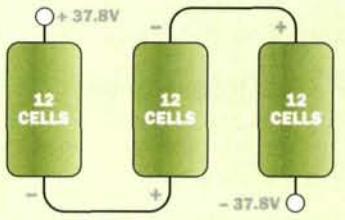
At 50A motor current, the load on these 3S4P packs is around six to seven times the batteries' capacity in mAh, and that is close to the maximum current limit of today's Li-poly cells. To date, Dave has charged and flown these packs about 30 times, and because these cells are still in the experimental phase, he maintains a log on the total voltage of each of the 3 packs (something the battery manufacturer, Thunder Power, also suggests).

Li-poly battery technology has come a long way this year. Progress in cell manufacturing techniques is measured month by month; by next year, we should see greater current (load) capability and reduced prices. Stay tuned!

THE CELL SETUP



A typical Thunder Power Li-poly 3S4P pack (with 3 cells wired in series, and then four series wired in parallel). This 12-cell pack setup has a 7800mAh capacity (4x1950mAh) and weighs only 16 ounces!



Dave uses 3, 3S4P packs wired in series for his Travel Air Mystery Ship. The packs still provide 7800mAh capacity and weigh 48 ounces.